2022

[HAZARD MITIGATION PLAN]

The Hazard Mitigation Plan (HMP) and its update represent a joint effort by the staffs of the Area Plan Commission, the Tippecanoe County Emergency Management Agency and the Planning Committee. This plan is a Multijurisdictional plan for Tippecanoe County, Lafayette, West Lafayette, Battle Ground, Dayton, Clarks Hill, Otterbein and Shadeland.

Resolutions

Battle Ground

Clarks Hill

Dayton

Lafayette

Otterbein

Shadeland

Tippecanoe County

West Lafayette

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EXECUTIVE SUMMARY OF THE HAZARD MITIGATION & FLOOD MITIGATION ASSISTANCE PLAN
2022 UPDATE

The Hazard Mitigation Plan (HMP) and its update represent a joint effort by the staffs of the Area Plan Commission and the Tippecanoe County Emergency Management Agency, Department of Homeland Security and the Members of the AHMP Planning Committee. Once fully adopted, this and all subsequent updates will be reviewed by the Tippecanoe County Board of Commissioners, City of Lafayette, City of West Lafayette, Town of Battle Ground, Town of Clarks Hill, Town of Dayton, Town of Shadeland, Town of Otterbein, Area Plan Commission and representatives of Purdue University, and the public. This plan also covers the unincorporated areas of Tippecanoe County such as the communities of Romney, West Point, Buck Creek & Stockwell.

IMPLEMENTATION AND FUNDING

Adoption of this plan and required updates ensure that the communities involved will be eligible for future federal disaster assistance as well as federal flood buyout money. It also enables the communities to apply for a variety of grants, such as Hazard Mitigation Grants (HMG), Building Resilient Infrastructure and Communities (BRIC) and other applicable Federal and State grant programs to implement projects to reduce damages and build more resilient, safer communities within Tippecanoe County. Some projects are easier to implement than others, because the cost can be absorbed in staff time. These include ordinance amendments, database management and public education. Other projects, such as watershed studies, the flood buyout program and purchasing additional outdoor warning sirens, require grant money.

Hazard Mitigation

"Hazard mitigation is sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects" fema.gov

HAZUS

HAZUS is a nationally applicable standard methodology that models for estimating potential losses from earthquakes and floods. HAZUS uses GIS data to estimate impacts of disasters. HAZUS is used in mitigation planning and preparedness.

The Hazard Mitigation Plan provides a comprehensive assessment of how specific hazards affect the community and proposes solutions to prevent future damage caused by natural and manmade hazards. It will also be used as a tool in future planning to assist community leaders, government departments and citizens to make informed decisions regarding land use, transportation and emergency management. Annual reviews will assess implementation progress and the success of mitigation strategies. Periodic updates will keep the plan current, provide new opportunities for innovative thinking, and allow for inclusion of additional mitigation projects and protective as well as community resilient measures.

1.0 INTRODUCTION

1.1 DISASTER LIFE CYCLE

The Federal Emergency Management Agency (FEMA) defines the disaster life cycle as the process through which the community and emergency managers respond to disasters when they occur, recover from disasters, reduce the risk of future losses and prepare for emergencies and disasters.

The disaster life cycle includes 4 phases:

- **Response** – the mobilization of the necessary emergency service and first responders to the disaster area
- **Recovery** – to restore the affected area to its previous state; includes rebuilding, re-employment, repair of infrastructure
- **Mitigation** – to prevent or reduce the effects of disasters through building codes, zoning, vulnerability analyses and public education
- **Preparedness** – planning, organizing, training, equipping, exercising, and evaluation and improvement activities to ensure the effective coordination and the enhancement of preparedness plans, emergency exercises, training and warning systems.

The Tippecanoe County Hazard Mitigation Plan (HMP) focuses on the mitigation phase of the disaster life cycle. According to FEMA, mitigation is sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects. Mitigation is most effective when it is based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs. The HMP planning process identifies hazards, the extent that they affect the municipality and formulates mitigation practices to reduce the social, physical and economic impact of the hazards.

1.2 PROJECT SCOPE AND PURPOSE

The development and update of a community Hazard Mitigation Plan (HMP) is a requirement of the Federal Disaster Act of 2000 (DMA 2000) and §201.6(d)(3)**: *"A local jurisdiction must review and revise this plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five years in order to continue to be eligible for mitigation project grant funding."***

In order for the National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt either their own HMP or participate in the development of a multi-jurisdictional HMP. This planning effort also includes Clarks Hill and Otterbien, both non-NFIP participating communities. Communities should enter the NFIP program as well as adopt established mitigation plans. The Indiana Department of Homeland Security (IDHS) and the

Federal Emergency Management Agency (FEMA) Region V offices administer the HMP program in Indiana. Historically, planning in Tippecanoe County has been accomplished by the Area Plan Commission for its participating jurisdictions; the same is true for this effort.

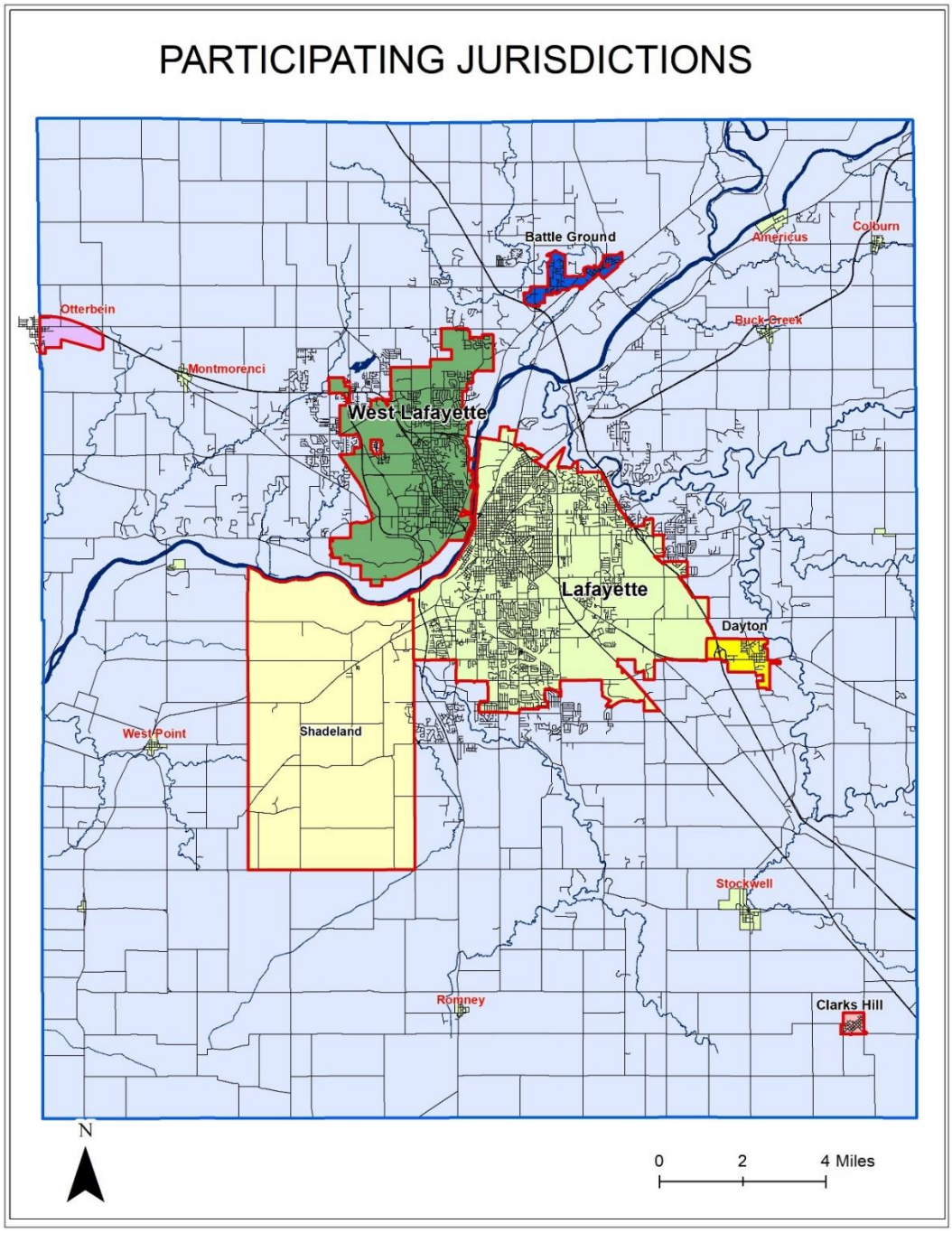

Exhibit 1 Geographical area covered by this plan

Exhibit 1 displays all the jurisdictions that have participated in this plan.

Development and update of the HMP is necessary requirement to implement, policy and project creations to mitigate adverse effects of hazards in Tippecanoe County. The purpose of this planning effort is to identify hazards and the extent they affect the residents of the county as well as to determine what type of mitigation strategies, goals or projects may be implemented for mitigating hazards. Although this HMP update meets the requirements of DMA 2000 and eligibility requirements of the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM) Grant, as well as other FEMA programs including the NFIP Community Ratings System (CRS), additional detailed studies may need to be completed prior to applying for grants and/or programs.

Tippecanoe County was awarded a grant for technical assistance. The grant was awarded to the Polis Center. The Polis Center performed HAZUS Modeling for Tornado, Flooding, Earthquake, and Hazardous Materials Release events. The Polis Center also provided review and guidance in FEMA compliance submittals. Funding for this project was provided by the Area Plan Commission of Tippecanoe County and the Indiana Department of Homeland Security.

1.3 THE PLANNING PROCESS

1.3.1 PLANNING COMMITTEE

The Area Plan Commission of Tippecanoe County is leading the multi-jurisdictional planning effort in collaboration with the Tippecanoe County Emergency Management Agency, Department of Homeland Security (TEMA-DHS). The plan update was prepared in partnership with Tippecanoe County, the City of Lafayette, and the City of West Lafayette along with the Towns of Battle Ground, Dayton, Shadeland, Otterbein and Clarks Hill. Representatives from these communities attended planning committee meetings, provided valuable information about their communities, reviewed and commented on the draft plan and held hearings to adopt the plan. Each community had an equal opportunity for participation and representation in the planning process. The process used to develop the Tippecanoe County HMP satisfies the requirements of a DMA 2000 multi-jurisdictional plan which provides that a plan may be accepted if each jurisdiction has participated in the planning process. §201.6(c)(1) states ***"The Plan shall document the planning process used to prepare the plan, including how it was prepared, who was involved in the process, and how the public was involved."***

The Tippecanoe County HMP Planning Committee was created specifically to review this plan and provide new information for its update. The membership of this committee included representatives from various county offices, the City of Lafayette, the City of West Lafayette, the Town of Battle Ground, the Town of Dayton, the Town of Clarks Hill, the Town of Otterbein, and the Town of Shadeland, all of whom have responsibility for disaster mitigation efforts in their respective jurisdictions. The Planning Committee also included representatives from emergency response agencies including TEMA-DHS and representatives from local fire, police and sheriff's departments as well as Purdue University, non-profit groups, public works, zoning and planning,

parks and recreation and local citizen representatives.

Meeting agendas and summaries are included in **Appendix A. Exhibit 2** is a list of all committee members.

Planning Committee Members

HMP 2022 Planning Committee		
Name	**Title**	**Representing**
David Hittle	Executive Director	Tippecanoe County APC
Larry Aukerman	Planner, CFM	Tippecanoe County APC
Ryan O'Gara	Assistant Director	Tippecanoe County APC
William "Smokey" Anderson	Director	TEMA-DHS
Marty Webb	Deputy Director	TEMA-DHS
Tom Murtaugh	County Commissioner	Tippecanoe County
Sharon Hutchinson	Grant Coordinator	Tippecanoe County
Kavita Kulkarni	GIS Coordinator	Tippecanoe County
Jeff Houston	Emergency Preparedness Coordinator	Tip. Co. Health Department
Mike Wolf	Building Commissioner	Tip. Co. Building Commission
Mike Spencer	Assistant Executive Director	Tippecanoe County Highway
Tim Balensiefer	Town Councilman	Town Of Shadeland
Zach Beasley	County Surveyor	Tippecanoe County Surveyor
Robert Goldsmith	County Sheriff	Tippecanoe County Sheriff
Terry Ruley	Chief Deputy	Tippecanoe County Sheriff
Jim Butcher	Project Manager	Tippecanoe County Surveyor
David Byers	County Commissioner	Tippecanoe County
Mitch Lankford	City Engineer	City of West Lafayette
Doug Cordell	TEMA Corrdinator	TEMA-DHS
Greg Jones	Town Council	Town of Battle Ground
Travis Catlin	Arconic	Arconic
Whitney Hobbs	Environmentalist	County Health Department
Ron Noles	Environmentalist	County Health Department
Rick Doyle	Fire Chief	City of Lafayette
Tracy Brown	County Commissioner	Tippecanoe County

HMP 2022 Planning Committee		
Name	**Title**	**Representing**
Art Choate	Captain	West Lafayette. Police Department
Randy Evans	Assistant Chief of Special Operations	Lafayette Fire Department
Carol Shelby	Senior Director Environmental Health & Safety	Purdue University
Kent Kroft	Director IT Department	Tippecanoe County
Glynis Boone	Manager Safety, Health, and Security	Evonik Industries
Scott Taylor	Town Marshal	Town of Dayton
Chad Spitznagle	Building Commissioner	City of West Lafayette
Lukas Darling	Deputy Town Administrator	Town of Otterbein
Carla Stearns	Town Council	Town of Clarks Hill
Stan Lambert	Director	Wabash River Enhancement Corporation
Eric Johnson	LEPC Chair	LEPC

Exhibit 2 Planning Committee

1.3.2 PUBLIC INVOLVEMENT IN THE PLANNING PROCESS

The planning process to prepare the Tippecanoe County HMP update began in early 2021. A Planning Committee was formed using guidelines from and requirements of DMA 2000. In winter 2021 the Planning Committee met to review any relevant changes to the plan including new hazard data, updating critical facilities and providing information about community projects and on-going mitigation efforts. Three public meeting were held. All three meetings were advertised in the newspapers and online. The first two meetings requested public input in the design of the plan and the third public meeting asked for comments on the draft plan.

1.3.3 NEIGHBORING COMMUNITY INVOLVEMENT

A draft copy of the plan was sent to the following neighboring counties. Details of neighboring stakeholders' involvement are summarized in the exhibit below.

Participant Name	Neighboring County/Community	Organization	Participation Description
Chris Springer	White County, IN	White County EMA	Received a draft of plan for review;
Phil Astell	Warren County, IN	Warren County EMA	Received a draft of plan for review;
Jason Fisher	Benton County, IN	Benton County EMA	Received a draft of plan for review;
Mike Fincher	Carroll County, IN	Carroll County EMA	Received a draft of plan for review;

Darryl Sanders	Clinton County, IN	Clinton County EMA	Received a draft of plan for review;
Shari Harrington	Montgomery County, IN	Montgomery County EMA	Received a draft of plan for review;
Joe Whitaker	Fountain County, IN	Fountain County EMA	Received a draft of plan for review;

Exhibit 3 Neighboring Community

1.4 PLANS, STUDIES, REPORTS AND TECHNICAL INFORMATION

During the development of the Tippecanoe County HMP Update, several relevant sources of information were reviewed. This exercise was completed to gather updated information since the previous HMP was created and to assist the planning committee in developing potential mitigation measures to reduce the social, physical and economic losses associated with hazards affecting Tippecanoe County. This meets the FEMA requirement of §201.6(c)(1): ***The plan shall include a review and incorporation, if appropriate, of existing plans, studies, reports and technical information.***

For the purposes of this planning effort, the following materials were utilized:

- Tippecanoe County Comprehensive Plan (1981)
- Benton County Hazard Mitigation Plan 2019
- *The Lafayette Journal and Courier* (archived and current articles)
- Tippecanoe County Flood Insurance Rate Maps
- Data Provided by Polis Center
- State of Indiana Mitigation Plan of 2019

2.0 COMMUNITY INFORMATION

Tippecanoe County was established in 1826. Located in west central Indiana, its area is 503.24 square miles, 3.44 square miles of which are water. The county seat is Lafayette, located near the middle of the county along the Wabash River.

2.1 TOPOGRAPHY

The topography and geography of Tippecanoe County has been greatly influenced by glaciations; alluvial action can be found on level glacial till plains eroded by stream valleys. The county covers an area of approximately 503 square miles and the major physiographic feature is the Wabash River. The River runs diagonally through the county from the northeast to the southwest, exiting near the center of the county's western boundary. There are two main tributaries to the Wabash River: the Tippecanoe River and Wildcat Creek. The Tippecanoe River enters the county from the north and is approximately 5.5 miles in length before its confluence with the Wabash River. There are two hydroelectric upstream damns on the Tippecanoe River in Carroll and White Counties. Wildcat Creek has three branches in all; two of which are state designated scenic rivers. All the branches merge before emptying into the Wabash near the center of the county.

The county slopes gently to the southwest and lies entirely within the drainage basin of the Wabash River. The greatest changes in elevation in the county naturally occur along the river valleys. The uplands lie approximately 700 feet above mean sea level (MSL), while elevations along the Wabash River range from 500' MSL to 510' MSL. The highest elevation is 833' near the southeastern corner of the county and the lowest elevation, 500', can be found where the Wabash River exits the county along the western county line.

2.2 CLIMATE

Indiana is in the hot-summer humid continental climate zone, with large seasonal temperature differences. The state has four distinct seasons with cold winters and hot and humid summers. Due to latitude differences, northern Indiana tends to be cooler than southern Indiana. Precipitation typically averages 40 inches per year, increasing from north to south. Indiana's climate is affected by both the Gulf of Mexico, with warm and humid air, and the jet stream, which brings polar air from Canada. The state is subject to extreme weather such as thunderstorms and tornadoes, especially in the spring. Spring is the wettest season, bringing with it floods, while fall tends to be drier.

Based on information from the State Climatologist's Office, the annual mean temperature in Tippecanoe County is 51º Fahrenheit. Historic extreme temperatures have ranged from -25ºF in 1994 to 105º F in 1983. The county experiences an annual average rainfall of 38.91 inches per year and an annual average snowfall of 22 inches. The driest month is typically February with 1.58 inches of precipitation and the wettest is June with 4.24 inches. The summer of 2012 was one of the driest on record, with most of the state under extreme to severe drought conditions. According to National Oceanic and Atmospheric Administration, (NOAA), Lafayette was 3 inches below normal precipitation levels in July 2012. It also set temperature records as Lafayette experienced 7 days over 100 degrees.

Drought is a period of unusually dry weather that persists long enough to result in negative impacts such as crop damage, decreasing water supply, and/or the ignition of wildfires. It is a normal, recurrent feature of climate that occurs in virtually all climate zones (National Oceanic and Atmospheric Administration, 2018). Drought is unique from other hazards, which can make it more challenging to manage and plan for effectively. It is unique because it often develops gradually, can last for months or years, and the spatial extent varies depending on the drought. There are cases, though, when drought develops relatively quickly and lasts a very short period of time, exacerbated by extreme heat and/or wind (i.e., flash drought).

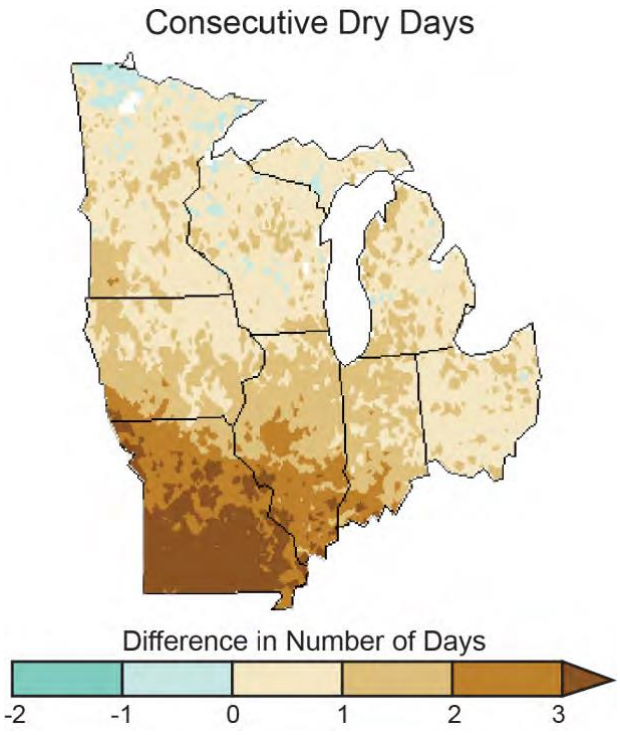

Exhibit 4 Consecutive Dry Days

Exhibit 4 shows the projected change in the average maximum number of consecutive days each year with less than 0.01 inches of precipitation for the middle of the current century (2041 – 2070) relative to the end of the last century (1971 – 2000) across the Midwest under continued emissions. An increase in this variable has been used to indicate an increase in the chance of drought in the future (USGCRP, 2018).

Even though recent decades have trended towards wetter conditions in Indiana, drought has been a prominent hazard known to impact the state (Figure 14). The drought of record for the state was in the early 1930s, while the most recent drought to impact Indiana was a flash drought in 2012. Even though the drought in 2012 pales in comparison to the droughts in the early 1900s, there were still significant negative impacts to Indiana in 2012. Indiana's agriculture saw a significant impact, with poor corn and soybean conditions, decreased crop yields (lowest corn yield in the last 75 years), issues with aflatoxin in corn, and Indiana's crop insurance payouts topped $1 billion for drought impacts on corn, soybeans, and wheat. In addition, water restrictions were implemented in major metropolitan areas such as Indianapolis, and burn bans were in effect in 84 of Indiana's 92 counties by July 2012 (National Drought Resilience Partnership, 2018).

2.2.2 Future Climate Trends

Scenarios are used to explore how much humans are likely to contribute to future climate change given uncertainties in factors such as population growth, economic development, and development of new technologies. In order to calculate how human activities could affect the climate system, scientists insert greenhouse gas concentrations, pollution, and changes in land cover to their models. How much emissions and land use change scientists should add depends on future social and economic development. This information is provided by scenarios produced by integrated assessment models (CICERO, 2018).

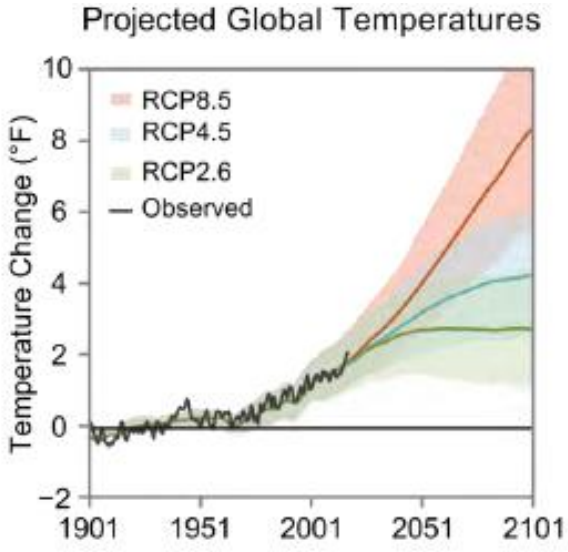

Exhibit 5 Projected Global Temperatures (USGCRP, 2017

Four emissions pathways are commonly used in future climate modeling, ranging from significantly reduced emissions levels to continuing the current-day high emissions trajectory. While all these scenarios are considered possible, the lowest emissions scenario is highly unlikely.

Exhibit 5 is a multimodal simulated time series from 1900 to 2100 for the change in global annual mean surface temperature relative to 1901-1960 for a range of the Representative Concentration Pathways (RCPs). These scenarios account for the uncertainty in future emissions from human activities, as analyzed with the 20+ models from around the world used in the most recent international assessment. The mean (solid lines) and associated uncertainties (shading, showing ±2 standard deviations across the distribution of individual models based on the average over 2081-2100) are given for all the RCP scenarios as colored vertical bars.

According to the Indiana Climate Change Impacts Assessment (IN CCIA) from 2018 (Widhalm, et al., 2018), Indiana weather is predicted to change this century. The main findings are listed below:

- Temperatures are projected to rise about 5-6°F by mid-century.
- The number of extremely hot days will rise.
- Extreme cold events will decline.

- The frost-free season will lengthen.

2.3 DEMOGRAPHICS

Population data, available from the 2019 Census, indicates a total population in Tippecanoe County of 195,732. Exhibit 6 below outlines additional population data.

2019 Tippecanoe County Population Data Estimates	
Community	**Population**
Tippecanoe County (total)	195,732
City of Lafayette	71,721
City of West Lafayette	50,996
Town of Battle Ground	1,975
Town of Dayton	1,668
Town of Shadeland	1,916
Town of Clarks Hill	727
Town of Otterbein (Benton & Tippecanoe Counties)	1,144

Exhibit 6 Population Data

2.4 ECONOMY

According to the US Census, the median household income in 2019 was $53,130. Tippecanoe County has long served as an employment and retail hub for an area of seven surrounding counties. This is evidenced by 21,778 workers who commute into Tippecanoe County for employment based on Indiana workers' tax returns. The county from which most workers come into Tippecanoe is Carroll County with over 2,900 employees making the commute.

Data from the Indiana Department of Workforce Development shows the workforce in Tippecanoe County totaled 94,147 people, with an unemployment rate in September 2020 of 6.3%. The county has also historically seen high education rates; 91.6% of people 25 years and older have at least a high school diploma, and 38.7% of those with a bachelor's degree or higher.

2.5 INDUSTRY

The largest employment sectors in Tippecanoe County are governments employing 24% of workers, manufacturing with 12.8% and health care and social services with 11.2% of the workforce population (BEA, 2019). Purdue University is the largest employer in the county with over 15,000 employees followed by Subaru of Indiana Automotive over 4000.

The Lafayette area is home to several industrial expansions and new investments in the last several years. Nanshan America opened a new 600,000 sq. ft. aluminum extrusion plant in 2012, employing 150 people. Additionally, GE Aviation opened an assembly plant to manufacture its new Leap engines, employing over 200 in 2015. Additional industry has located in Tippecanoe County including Nanshan Aluminum as well as Dow Agro Sciences in Purdue's Research Park. The Indiana Clarian Arnett and St. Elizabeth East Hospitals continue to expand as medical facility

needs continue to increase. Saab announced the grand opening of a new manufacturing/research facility located in West Lafayette, Indiana on October 2021

2.6 LAND USE AND DEVELOPMENT TRENDS

Tippecanoe County has experienced steady growth in both population and employment since the late 1980's/early 1990's when Subaru International Automotive plant and Wabash National semi-trailer plant located and began operations here. Residential growth continues to be evidenced in the number of single-family home building permits. The county, much like the rest of the country, went through a period of stagnation and decline in the mid-2000s. New buildings have increased in number as the economy grew after the last recession in 2008, as evidenced by a rise in permits for new construction.

New residential development has been concentrated on the south and east sides of Lafayette and north and northwest sides of West Lafayette. An area for future industrial expansion is reserved on the southeastern side of Lafayette; some of the land is in the unincorporated county but will be served by sanitary sewer and water from Lafayette. The Purdue Research Park on West Lafayette's north and west sides has additional room for expansion. Several recent Tax Increment Finance Districts have been created to promote further investment and infrastructure development.

2.7 RIVERS AND WATERSHEDS

According to the Indiana Department of Environmental Management (IDEM), there are 65 waterways in Tippecanoe County. Exhibit 7 lists the waterways identified. All the county's waterways drain into the Wabash River.

List of Waterways		
Anderson Ditch	Bee Run	Big Shawnee Creek
Blickenstaff Ditch	Bowers Creek	Box Ditch
Bridge Creek	Brown Ditch	Buck Creek
Buck Creek Ditch	Burnett Creek	Coffee Run Creek
Cole Ditch	Darby Ditch	Dismal Creek
Dry Run	Durkee Creek	E. Branch Big Wea
East Branch Wea Creek	Edward Ditch	Elliott Ditch
Flint Creek	Flint Run	Goose Creek
Harrison Creek	Haywood Ditch	Hentz Ditch
Hoffman Ditch	Hog Run	Ilgenfritz Ditch
Indian Creek	Jordan Creek	Kellerman Lea Ming Ditch
Lauramie Creek	Little Flint Creek	Little Pine Creek
Little Sugar Creek	Little Wea Creek	Lofland Ditch
Lost Creek	Marshall Ditch	McFarland Ditch
McKinney Ditch	Montgomery Ditch	Middle Fork Wildcat Creek
Moots Creek	Moses Baker Ditch	North Fork Wildcat Creek
North Fork Burnett Creek	O'Neall Ditch	South Fork Wildcat Creek
Otterbein Ditch	Philip Dewey Ditch	Platt Ditch

Resser Ditch	Romney Fraley Ditch	Southworth Branch
Stock Farm Ditch	Stoddard Ditch	Sugar Creek
Tippecanoe River	Wabash River	Wallace Ditch
Walters Ditch	Wea Creek	

Exhibit 7 Waterways

According to IDEM, there are 47 Hydrologic Unit Code (HUC) watersheds in Tippecanoe County. Exhibit 8 lists the identified watersheds.

List of 14-Digit HUC Watersheds		
14-Digit HUC#	**14-Digit HUC NAME**	**Total Acres**
05120106150050	Tippecanoe River-Main Stem	10754.1
05120106150060	Rayman Ditch/Myers Ditch	13230.7
05120105060010	Wabash River-Bowen Ditch	6854.6
05120106150080	Moots Creek-Tippecanoe River Outlet	12325.5
05120108040070	Big Pine Creek-Brumm Ditch	11022.9
05120108010020	North Fork Burnett Creek-Brown Ditch	11598.2
05120108010010	Burnett Creek-Headwaters	16772.5
05120105060020	Wabash River-Bridge Creek	8218.5
05120108040080	Big Pine Creek-Darby Ditch	11773.2
05120108010030	Burnett Creek-Wabash R Bottoms	6573.8
05120108030020	Indian Creek (Tippecanoe)	18960.6
05120108030060	Little Pine Creek-McFarland/Otterbein Ditches	13175.2
05120105070030	Wabash River-Harrison Creek	5114.6
05120105070010	Sugar Creek-Little Sugar Creek (Tippecanoe)	18360.6
05120105070020	Buck Creek (Tippecanoe)	7495
05120107020100	Wildcat Creek-Pyrmont	14949.1
05120107050010	Wildcat Creek-Dry Run	8994.8
05120108010040	Wabash River-Lafayette	14088.1
05120108030070	Little Pine Creek-Armstrong Creek	13404.4
05120108030010	Wabash River-Jordan Creek	10027.6
05120107030070	Middle Fork Wildcat Creek-Pettit	6768.9
05120107040140	South Fork Wildcat Creek-Cary Camp	4524.4
05120107030060	Middle Fork Wildcat Creek-Hog Run	12877
05120107040130	South Fork Wildcat Creek-Dayton	14307.6
05120108020070	Elliot Ditch	11886.8
05120108030030	Wabash River-Lost Creek	16841.3
05120108020090	Wea Creek-Outlet	3009.3
05120108030050	Wabash River-Flint Creek/Grindstone Creek	15242.6
05120108020080	Little Wea Creek	21379.7
05120108020060	Wea Creek-Kenny Ditch	15193.3
05120107040110	South Fork Wildcat Creek-Mulberry	13323.4
05120108030040	Flint Creek-Flint Run	13964.5
05120107040120	Lauramie Creek	15090.8
05120108070020	Shawnee Creek-Headwaters (Fountain)	23784.8

List of 14-Digit HUC Watersheds		
14-Digit HUC#	**14-Digit HUC NAME**	**Total Acres**
05120108020050	East Branch Wea Creek-Platt Ditch	7375
05120108020030	Wea Creek-Haywood/Kellerman Leaming Ditch	11279
05120108020040	East Branch Wea Creek-Headwaters	10982.5
05120108070030	Shawnee Creek-Kell Dt/Little Shawnee	17382.7
05120108020020	Romney Fraley Ditch	8782
05120110030030	Bowers Creek	11919.6
05120108020010	Lofland Ditch-Phillip Dewey/Stoddard Ditches	14588.3
05120108100020	North Fork Coal Creek-Lower	14704.5
Total		**518902**

Exhibit 8 Watersheds

2.8 CRITICAL FACILITIES

FEMA provides some guidance for selecting critical and non-critical facilities and describes some approaches to identifying those facilities. FEMA's Public Assistance Guide (FEMA 322) states "Critical facilities are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to shelters, police and fire stations, and hospitals." The related regulation at 44 CFR 206.226, restoration of damaged facilities states that "eligible private nonprofit facilities may receive funding under the following conditions: the facility provides critical services which include power, water (including water provided by an irrigation organization or facility in accordance with 206.221(e)(3)), sewer services, wastewater treatment, communications, emergency medical care, fire department services, emergency rescue and nursing homes." Thus, critical facilities appear to fulfill important functions in maintaining community stability and living conditions.

The following list suggests some examples of potential critical facilities:

- Structures or facilities that produce, use or store highly volatile, flammable, explosive, toxic, and/or water-reactive materials;
- Hospitals, nursing homes and housing likely to have occupants who may not be sufficiently mobile to avoid injury or death during a hazard;
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during and after a hazard; and
- Utility facilities that are vital to maintaining or restoring normal services to areas before, during and after a hazard.

The Planning Committee reviewed the critical facilities included in the 2016 Plan. Changes made to the list include noting which facilities have closed, moved or were newly constructed. The updated critical facility list includes two hundred and thirty-three (233) critical facilities in Tippecanoe County.

These facilities include 5 dams, 53 schools (including Purdue University and Ivy Tech State College), 10 public/private airports, 9 police stations (including 1 jail), 1 National Guard Facility,

23 fire stations, 20 nursing/veteran's/children's homes, 4 hospitals, 17 potable water facilities (including all of the City of Lafayette and the Indiana-American Water Company wells), 8 wastewater facilities, 5 bus/train stations, 10 broadcast facilities and 67 hazardous material facilities.

3.0 RISK ASSESSMENT

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, disruption to local and regional economies, and the expenditure of public and private funds for recovery. Sound mitigation practices must be based on sound risk assessment. A risk assessment involves quantifying the potential loss resulting from a disaster by assessing the vulnerability of buildings, infrastructure, and people. A risk assessment consists of three components: hazard identification, vulnerability analysis, and risk analysis.

3.1 HAZARD IDENTIFICATION/RECORDS

3.1.1 Hazards Discussed by the Planning Committee

Hazards Discussed			
List of Hazards	**Hazard Type**	**Hazard with local Impact**	**Hazard for Detail study in this plan**
Aircraft Incident	Tech & Human	Yes	No
Animal Disease Outbreak	Natural & Human	Yes	No
Armed Assailant	**Human**	**Yes**	**Yes**
Building/Structure Collapse (Bridge)	Tech	Yes	No
Building/Structure Collapse (Building)	Tech & Human	Yes	No
Bomb Threat (Government Facility)	Human	Yes	No
Bomb Threat (Critical Infrastructure)	Human	Yes	No
Civil Unrest	Human	Yes	No
Critical Communications Failure (VHF)	Human	Yes	No
Critical Communications Failure (800mthz))	Human	Yes	No
Critical Communications Failure (Cell)	Human	Yes	No
Critical Communications Failure (Landline)	Human	Yes	No
Critical Communications Failure (Internet)	Human	Yes	No
Cyber Attack	Human	Yes	No
CBRNE - Chemical	Human	Yes	No
CBRNE – Biological	Human	Yes	No
CBRNE - Radiological	Human	Yes	No
CBRNE - Nuclear	Human	Yes	No
CBRNE - Explosive	Human	Yes	No
Avalanche	Nature	No	No
Coastal Erosion	Nature	No	No

Hazards Discussed			
List of Hazards	**Hazard Type**	**Hazard with local Impact**	**Hazard for Detail study in this plan**
Coastal Storm	Nature	No	No
Dam Failure	**NAT, TNL & HCI**	**Yes**	**Yes**
Levee Failure	Natural & Human	Yes	No
Drought	Nature	Yes	No
Disaster Recovery	Natural & Human	Yes	No
Disaster Recovery (Short Term Sheltering)	Natural & Human	Yes	No
Disaster Recovery (Long Term Sheltering)	Natural & Human	Yes	No
Disaster Recovery (Mass Supply Disruption)	Natural & Human	Yes	No
Disaster Recovery (Commodity Storage)	Natural & Human	Yes	No
Disaster Recovery (Commodity Distribution)	Natural & Human	Yes	No
Earthquake	**Nature**	**Yes**	**Yes**
Expansive Soils	Nature	Yes	No
Land Subsidence/Land Slide	**Nature**	**Yes**	**Yes**
Sinkhole	Nature	Yes	No
Bank Erosion	Nature	Yes	No
Scouring	Nature	Yes	No
Soil Erosion	Nature	Yes	No
Extreme Heat	Nature	Yes	No
Extreme Cold	Nature	Yes	No
Flood	**Nature**	**Yes**	**Yes**
Flood (Ice Flows & Jams)	Nature	Yes	No
Hurricane	Nature	No	No
Hazardous Materials (storage & transport)	**Tech**	**Yes**	**Yes**
Hazardous Materials (Release/Spill)	Human	Yes	No
Lost Person(s) (Special Needs)	Human	Yes	No
Mass Casualty Incident	Natural & Human	Yes	No
Mass Fatality Incident	Natural & Human	Yes	No
Public Health Emergency	Human	Yes	No
Public Health (Mass Emergency Care)	Natural & Human	Yes	No
Public Health (Medical Surge)	Human	Yes	No
Public Health (Outbreak)	Human	Yes	No
Public Health (Epidemic)	Human	Yes	No
Public Health (Pandemic)	Human	Yes	No
Public Health (Biological Attack)	Human	Yes	No
Public Health (Ebola)	Nature	Yes	No
Public Health (H1N1)	Nature	Yes	No
Public Health (COVID)	Nature	Yes	No

Hazards Discussed			
List of Hazards	**Hazard Type**	**Hazard with local Impact**	**Hazard for Detail study in this plan**
Rail Transportation (Passenger Incident)	Tech & Human	Yes	No
Rail Transportation (Hazardous Materials)	Tech & Human	Yes	No
School Violence (K-12)	Human	Yes	No
School Violence (Higher Education)	Human	Yes	No
Severe Winter Storm (Snow Accumulation)	Nature	Yes	No
Severe Winter Storm (Snow Removal & Storage)	Nature	Yes	No
Severe Winter Storm (Long-term Event)	Nature	Yes	No
Severe Winter Storm (Ice)	**Nature**	**Yes**	**Yes**
Severe Winter Storm (Hailstorm)	Nature	Yes	No
Severe Weather (Tornado)	**Nature**	**Yes**	**Yes**
Severe Weather (Windstorm, Derecho Event)	**Nature**	**Yes**	**Yes**
Tsunami	Nature	No	No
Volcano	Nature	No	No
Wildfire	Nature	Yes	No
Utilities (gas, sewer, water, electricity)	**Natural & Human**	**Yes**	**Yes**

Exhibit 9 Hazards Studied

Some of the Hazards listed above will have studies performed outside of this planning process. This is an ongoing process on an as needed basis primarily associated with TEMA-DHS.

Identifying and prioritizing the hazards the community is exposed to are the first steps before conducting a risk assessment. The previous Tippecanoe County HMP identified the major hazards to which Tippecanoe County is exposed. The following sections present historical data regarding hazard incidents and resultant costs in Tippecanoe County.

After identifying hazards, the Planning Committee helped prioritize them by importance and potential for disruption to the community. A tool for prioritizing hazards is the Calculated Priority Risk Index (CPRI) adopted from MitigationPlan.com. The CPRI evaluates each hazard based on its probability of occurrence, severity, warning time and duration. This tool provides a means of assessing each hazard as compared to other hazards.

To determine the CPRI, a value of 1 through 4 is assigned to each of the following categories:

- probability (unlikely – highly likely);
- magnitude/severity (negligible – catastrophic);
- warning time (more than 24 hours – less than 6 hours); and
- duration of event (less than 6 hours – greater than 1 week).

The following formula calculates the CPRI value:

- CPRI = Probability X 0.45 + Magnitude/Severity X 0.30 + Warning Time X 0.15 + Duration of Event X 0.10

Exhibit 10 summarizes the CPRI for all the studied hazards in this planning effort.

Calculated Priority Risk Index for Tippecanoe County					
	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • >24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration** • < 6 hrs • <1 day • < 1 wk • > 1 wk	**CPRI**
Hazardous Materials	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9
Flooding	Highly Likely	Critical	< 6 hrs	> 1 wk	3.7
Tornado/Windstorm	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Severe Winter Storm	Highly Likely	Critical	12-24 hrs	< 1 wk	3.6
Armed Assailant	Highly Likely	Limited	< 6 hrs	< 1 day	3.2
Earthquake	Highly Likely	Limited	< 6 hrs	< 6 hrs	3.1
Land Subsidence/Slide	Likely	Limited	< 6 hrs	< 6 hrs	2.7
Dam Failure	Possible	Critical	< 6 hrs	< 6 hrs	2.5
Utilities	Possible	Negligible	< 6 hrs	< 1 day	2.0

Exhibit 10 CPRI Table

According to the CPRI, historical data and knowledge provided by local planning and emergency professionals and committee members, the storage, transport, and spills of hazardous materials (3.9) ranked as the highest priority hazard for Tippecanoe County, followed by flooding (3.7), and tornado/windstorm (3.7). Section 3.2 includes a profile of individual hazards as well as CPRI values for each community that participated in the planning process.

3.1.2 Historical Hazards

Historical storm event data was compiled from the National Centers for Environmental Information, (NCEI). NCEI records are estimates of damage reported to the National Weather Service (NWS) from various local, state, and federal sources. It should be noted that these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to given weather events. The NCEI data included 645 reported events in Tippecanoe County from 1953 to 2020. The counts of these events by category is represented in Exhibit 11.

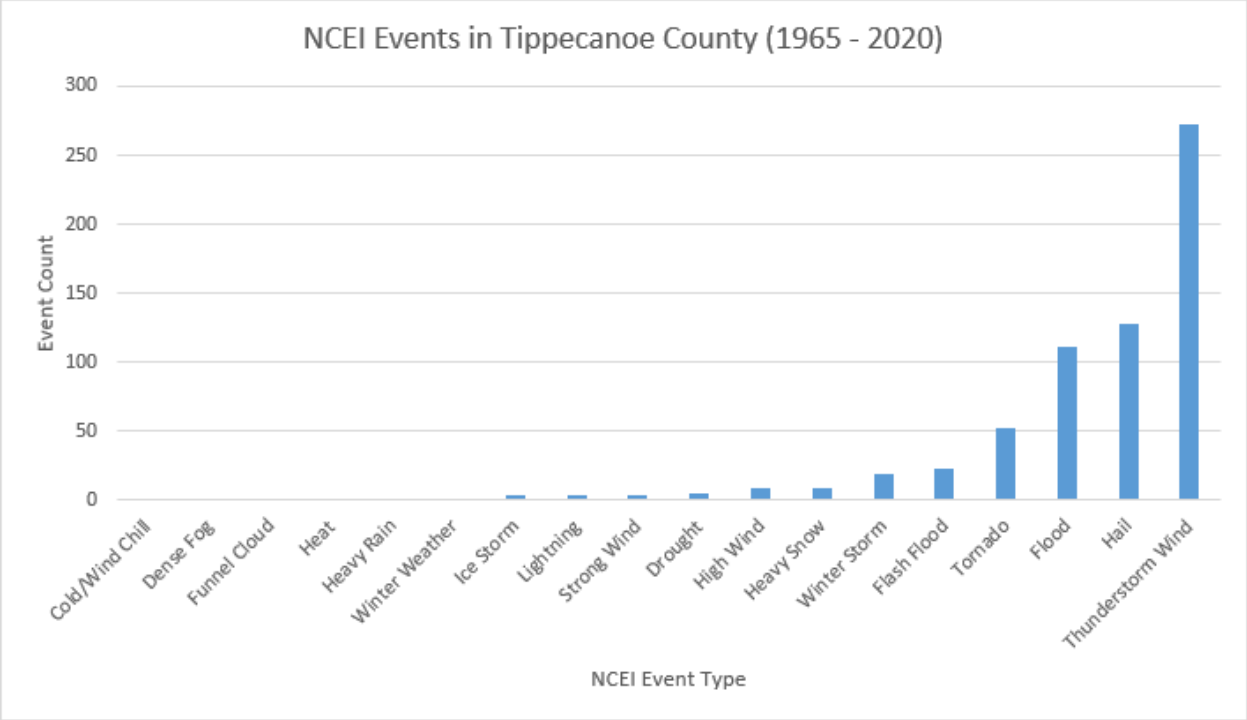

Exhibit 11 Count of NCEI Events in Tippecanoe County (1965-2020)

NCEI reports 87 events from January 2016 to December 2020. These recent events and their counts are reported in exhibit 12.

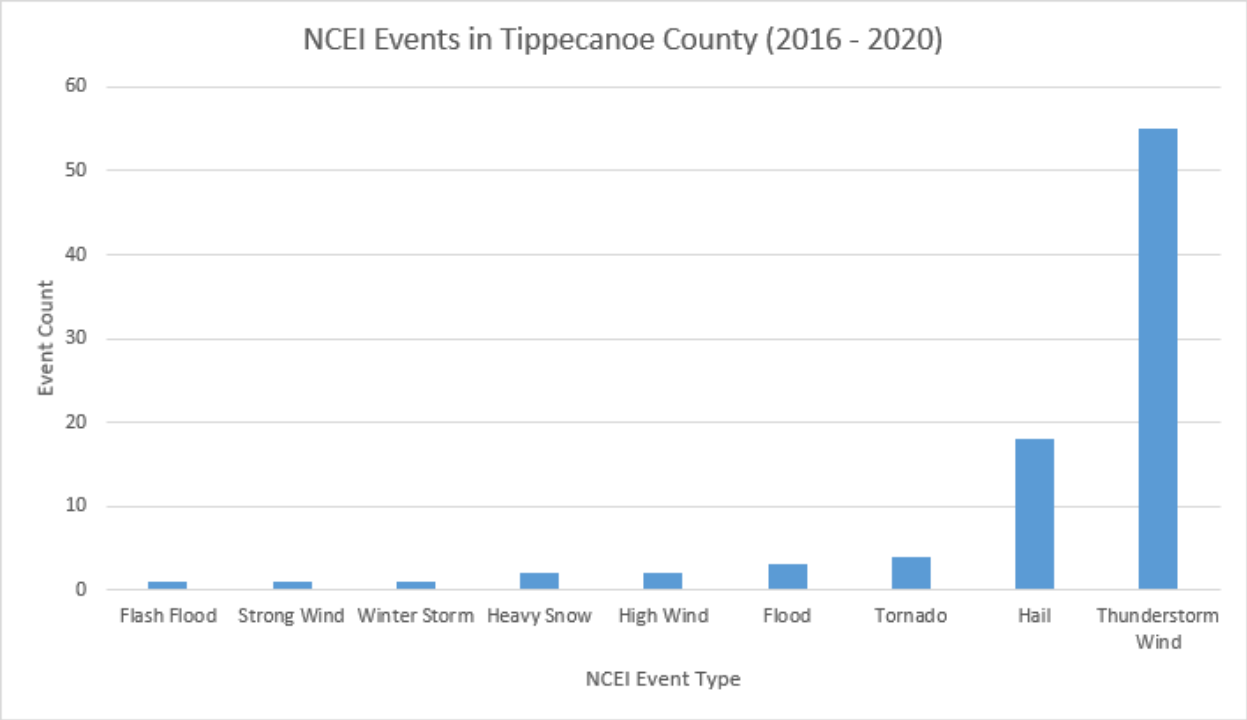

Exhibit 12. NCEI Events in Tippecanoe County since Previous MHMP (2016-2020)

3.1.3 FEMA Declared Disasters

Since 2000, FEMA has declared 20 disasters for the state of Indiana. Exhibit 11 shows the number of disaster declarations by county. Exhibit 12 shows the details of the major disaster declarations, including FEMA hazard mitigation funding and total assistance, for Tippecanoe County. Tippecanoe County has received federal aid for 6 declared disasters.

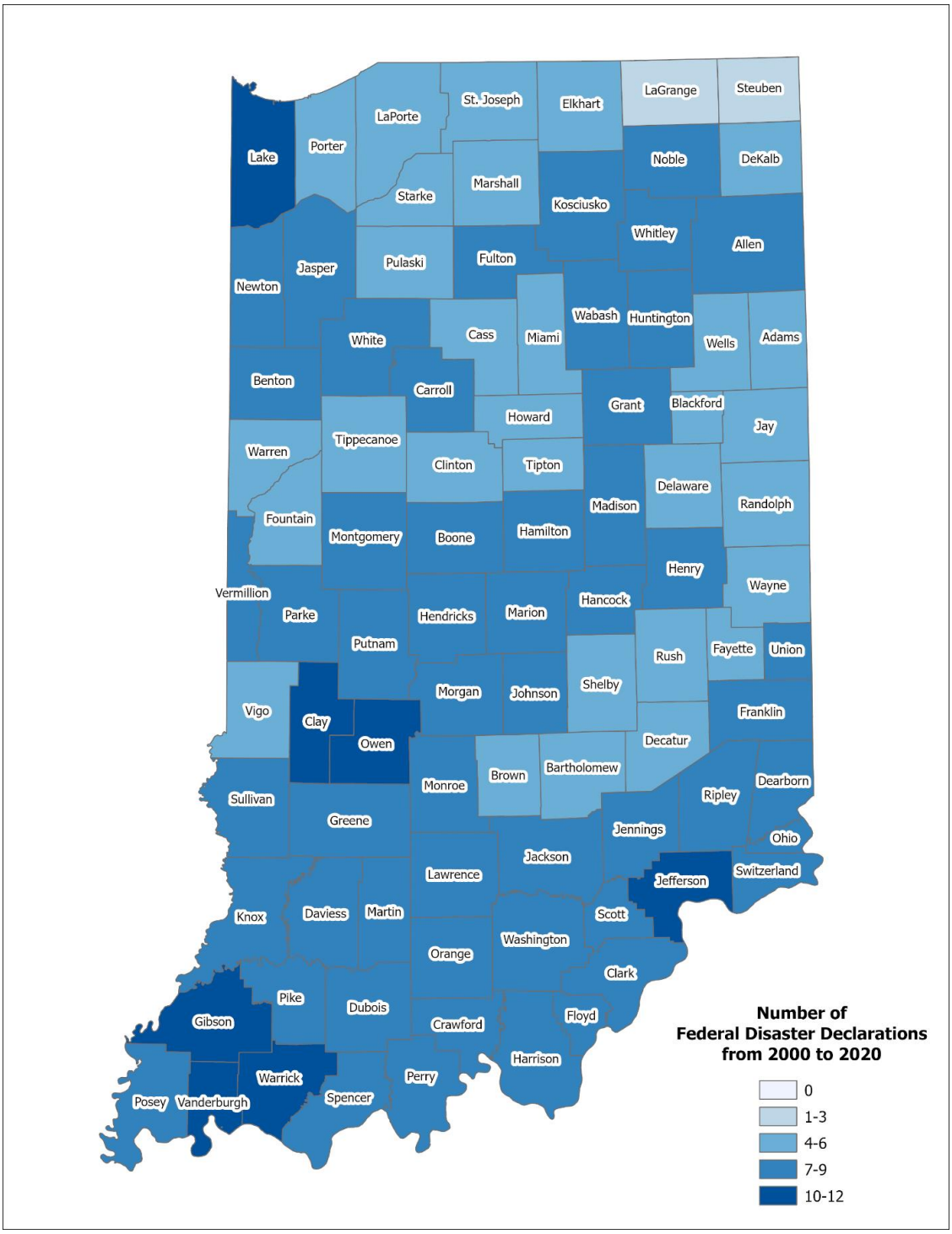

Exhibit 13. Disaster Declarations for Indiana

Disaster Number	Date of Incident	Date of Declaration	Disaster Description	Type of Assistance
1476	7/4/2003 – 8/6/2003	9/25/2002	Severe storms, tornadoes, and flooding	IH, IA, PA, HM
1520	5/25/2004 – 6/25/2004	6/3/2004	Severe storms, tornadoes, and flooding	IH, IA, PA, HM
1573	1/1/2005 – 2/11/2005	1/21/2005	Severe winter storms and flooding	IH, IA, PA, HM
1740	1/7/2008 – 3/14/2008	1/30/2008	Severe storms and flooding	IH, IA, HM
1766	5/30/2008 – 6/27/2008	6/8/2008	Severe storms, flooding, and tornadoes	IH, IA, HM
4515	1/20/2020 - Present	4/3/2020	COVID-19 pandemic	IH, PA

Exhibit 14. FEMA-Declared Disasters and Emergencies for Tippecanoe County (2000-2021)

Exhibit key:

PA – Public Assistance Program

IA – Individual Assistance Program

IH – Individual and Household Assistance Program

HM – Hazard Mitigation Grant Program

3.1.4 Other Disaster Relief

In addition to potential state funding, homeowners and businesses can be eligible for low-interest and long-term loans through the U.S. Small Business Administration (SBA). SBA was created in 1953 as an independent agency of the federal government to aid, counsel, assist, and protect the interests of small business concerns. The program also provides low-interest, long-term disaster loans to businesses of all sizes, private nonprofit organizations, homeowners, and renters following a declared disaster. The loans can also provide resources for homeowner associations, planned unit developments, co-ops, condominiums, and other common-interest developments. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

Through the disaster loan program, SBA provides loan data, including FEMA and SBA disaster numbers, type (business or home), year, and various reporting amounts on the verified and approved amount of real estate and contents. Exhibit 15 outlines the SBA data for the county.

Year	FEMA Declaration	SBA Disaster Number	Community	Type	Total Verified Loss	Total Approved Loan Amount
2004		13883	Lafayette	Home	$21,573	$0

Exhibit 15. SBA Declaration Data for Tippecanoe County (2010 – 2019)

3.2 VULNERABILITY ASSESSMENT

3.2.1 Asset Inventory

The vulnerability assessment builds upon the previously developed hazard information by identifying the community assets and development trends. Determining the hazard rank is pertinent to determining the area of vulnerability. The county infrastructure and facilities inventories are a critical part of understanding the vulnerability at risk of exposure to a hazard event.

The assets presented in the analysis results are broken into two main groupings: Facilities Inventory and Building Inventory. The facilities inventory is reviewed and updated by the county before the analysis begins. The building inventory is created by the analysis team using assessor data combined with either parcel centroids or building footprints depending on what was provided by the county. The creation and update process for these two asset groups are described below.

3.2.2 Facilities Inventory

Of the approximately 15 facility categories, five are essential: schools, police and fire stations, medical facilities and emergency operation center(s). The remaining facilities are referred to as critical and include a variety of facility types that are critical to the everyday operations of the county. The local planning committee updates these critical facilities using the previous plan's GIS data as the starting point. The facilities and their counts for the county are listed in Exhibit 16. At the beginning of the planning process these facilities were reviewed by the committee and updates were provided to the Polis Center. These updated facilities are provided to the county as well as being maintained in a statewide database by The Polis Center.

Facility Type	Number of Facilities
Care Facilities	94
Emergency Operations Centers	1
Fire Stations	23
Police Stations	11
Schools	51

Exhibit 16. Localized Hazards for Incorporated Jurisdictions

3.2.3 Building Inventory

In 2018, Microsoft released 125 million building footprints for the United States that were generated from imagery using machine learning (https://github.com/Microsoft/USBuildingFootprints). This data is licensed through the Open Data Commons Open Database License. Microsoft updated the data in 2021. The Polis Center extracted the building footprints for the state of Indiana and created point centroids of each building. Each building centroid was then joined spatially to the state's land parcels provided by the Indiana Geographic Information Office in March 2021. This process provided the parcel identifier for each building and was then linked to the statewide Real Property Tax Assessment Data provided by the Indiana Department of Local Government Finance (IDLGF) in November 2020. Indiana counties annually submit an extract of property appraisal data to the IDLGF that contains detailed building information such as square footage, construction type, year built, foundation type, and building replacement cost. The IDLGF data allows Polis to identify the occupancy class of each building based on the parcel within which it is located. Approximately 1% of the buildings were not located in a parcel and were not included. Exhibit 17 provides the summary of building counts and

replacement costs joined to the IDLGF data for Tippecanoe County summarized by occupancy type. NOTE: The assessor records often do not include nontaxable parcels and associated building improvements; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

Occupancy Code	Count	Replacement Cost
Residential	46,262	$9,452,045,390
Commercial	1,980	$725,460,676
Industrial	129	$190,798,169
Agriculture	1,600	$340,470,960
Religious	472	$455,974,136
Government	115	$33,832,136
Education	14	$3,818,341
Total	**50,572**	**$11,202,399,808**

Exhibit 17. Building Counts and Estimated Replacement Costs for Tippecanoe County

3.2.4 Hazus-MH

Potential impacts from flooding and earthquake hazards were quantified using FEMA's Hazus-MH Risk Assessment tool (https://www.fema.gov/hazus) and other forms of Geographic Information Systems (GIS) analysis that leveraged this data.

It is important to note that Hazus-MH is not a substitute for detailed engineering studies. Rather, it serves as a planning aid for communities interested in assessing their risk to flood, earthquake, and hurricane-related hazards. This documentation does not provide full details on the processes and procedures completed in the development of this project.

3.2.5 Past and Future Development

Recent or proposed development, especially in Special Flood Hazard Areas (SFHAs), must be carefully evaluated to ensure that no adverse impacts occur as a result. Development, whether it is a 100-lot subdivision or a single lot big box commercial outlet, can result in large amounts of fill and other material being deposited in flood storage areas or other vulnerable locations.
As the county's population shifts and develops, the residential and urban areas may extend further into the county, placing more pressure on existing transportation and utility infrastructure while increasing the rate of farmland conversion. Tippecanoe County addresses specific mitigation strategies in Chapter 5 to alleviate such issues.

Because Tippecanoe County is vulnerable to a variety of natural and technological threats, the county government, in partnership with the state government, is committed to preparing for the management of these type of events for better emergency management and county response.
According to the Indiana Department of Local Government Finance, 2,216 of Tippecanoe County's parcels have experienced some sort of construction since 2016. Of those, 161 are located within either the special flood hazard areas, the tornado path area or the toxic plume area, identified in sections, 4.1, 4.4, and 4.8 of this plan.

3.3 HAZARD RPOFILES

The following hazard profiles outline the hazard risk exposure for the county. The hazard is first described and then reviewed in the historical context of the county. In many cases, an analysis subsequently follows the hazard context that analyzes the facility and building inventory risk.

3.3.1 Flash Flood and Riverine Flood

3.3.1.1 Hazard Definition for Flooding

Flooding is a significant natural hazard throughout the US. The type, magnitude, and severity of flooding are functions of the amount and distribution of precipitation over a given area, the rate at which precipitation infiltrates the ground, the geometry of the catchment, and flow dynamics and conditions in and along the river channel. Floods in Tippecanoe County can be classified as one of two types: flash floods or riverine floods, which are both common in Indiana.

Flash floods generally occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in local-intense damage and, sometimes, loss of life due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person, while another 18 inches might carry off a car. Generally, flash floods cause damage over relatively localized areas, but they can be quite severe in the areas in which they occur. Urban flooding is a type of flash flood. Urban flooding involves the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Flash floods can occur at any time of the year in Indiana, but they are most common in the spring and summer months.

Riverine floods refer to floods on large rivers at locations with large upstream catchments. Riverine floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for riverine floods than for flash floods, generally providing ample warning for people to move to safe locations and, to some extent, secure property against damage. Riverine flooding on the large rivers of Indiana generally occurs during either the spring or summer.

3.3.1.2 Stream Gauges

The USGS, in cooperation with many state agencies and local utility and surveyor offices, help maintain stream gages, which provide the capability to obtain estimates of the amount of water flowing in streams and rivers. IDNR and IDEM use the stream gage data for water quantity and quality measurements. Local public safety officials use the data at these sites, along with the resources from the NWS, to determine emergency management needs during periods of heavy rainfall. The location of stream gages in the county are shown in Exhibit 18.

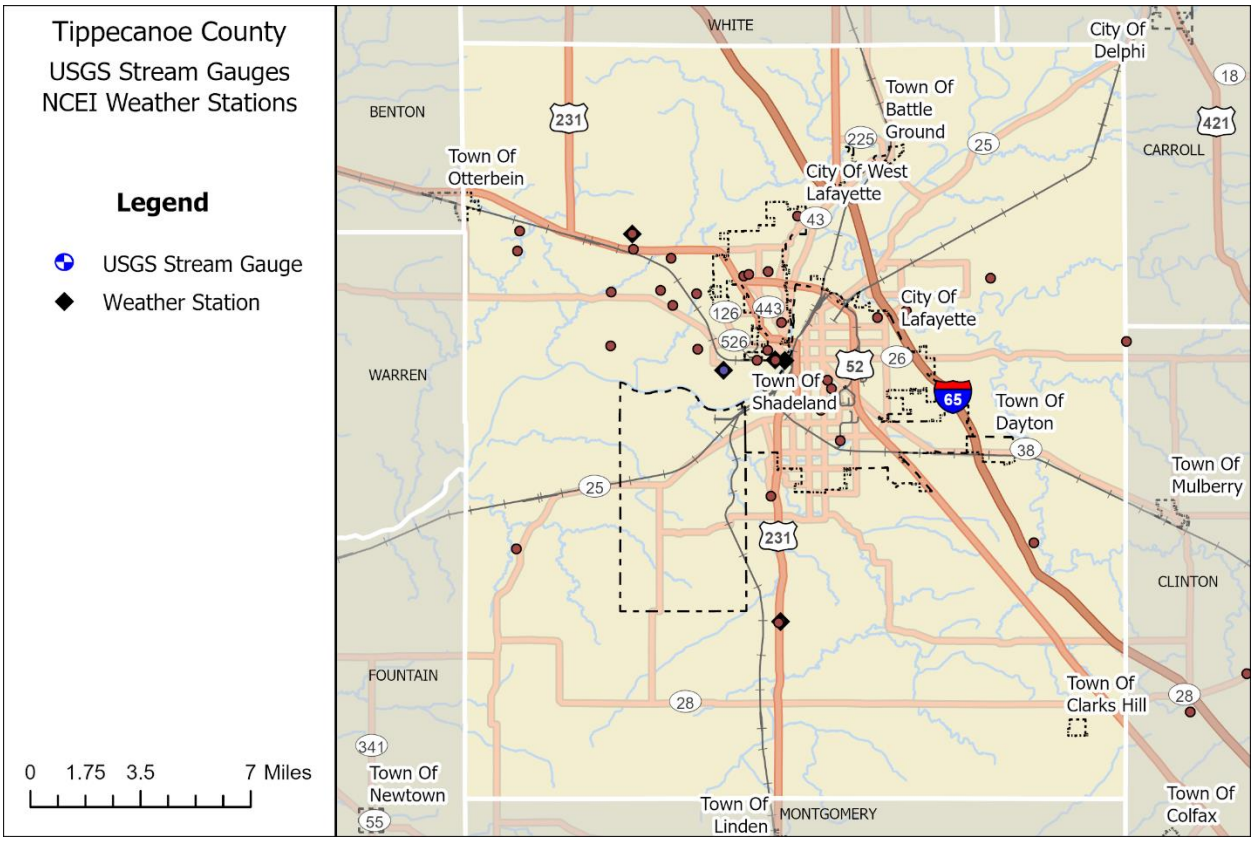

Exhibit 18. USGS Stream Gages and NCEI Weather Stations

3.3.1.3 Flood History in Tippecanoe County

Tippecanoe County has experienced a total of 134 flooding events since 1996, 11 of which have occurred from 2010 through 2020. Two of these were flash flooding incidents and the rest were reports of flooding. In June 2019, a heavy thunderstorm led to 3 feet of water in portions of the Tippecanoe Mall with rapidly flowing water in a nearby subdivision, leading to an estimated $100,000 in property damage. In May 2017, seven people and a dog were rescued by airboat while camping near the city's wastewater treatment plant due to rising water. In February 2014, an ice jam break led to damaged homes along Wildcat Creek. Additionally, the Conservation Club Road area began to flood, trapping more than 100 people and 50 vehicles in the Legacy Sports Complex, leading to an estimated $450,000 in property damage.

3.3.1.4 Geographic Location for Flooding

Most river flooding occurs in early spring and is the result of excessive rainfall and/or the combination of rainfall and snowmelt. Severe thunderstorms may cause flooding during the summer or fall, but tend to be localized. According to the Tippecanoe County Flood Insurance Study (FIS), major flooding in the county primarily occurs along the Wabash River, Burnett Creek, Wildcat Creek, Little Wea Creek, and Elliott Ditch.

Flash floods, brief heavy flows in small streams or normally dry creek beds, also occur within the county. Flash flooding is typically characterized by high-velocity water, often carrying large amounts of debris. Urban flooding involves the overflow of storm drain systems and is typically the result of inadequate drainage following heavy rainfall or rapid snowmelt.

3.3.1.5 Hazard Extent for Flooding

The Special Flood Hazard Areas (SFHA) are defined as the areas that will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year. The 1% annual chance flood is also referred to as the base flood or 100-year flood. The SFHAs in Tippecanoe County are identified in Exhibit 19.

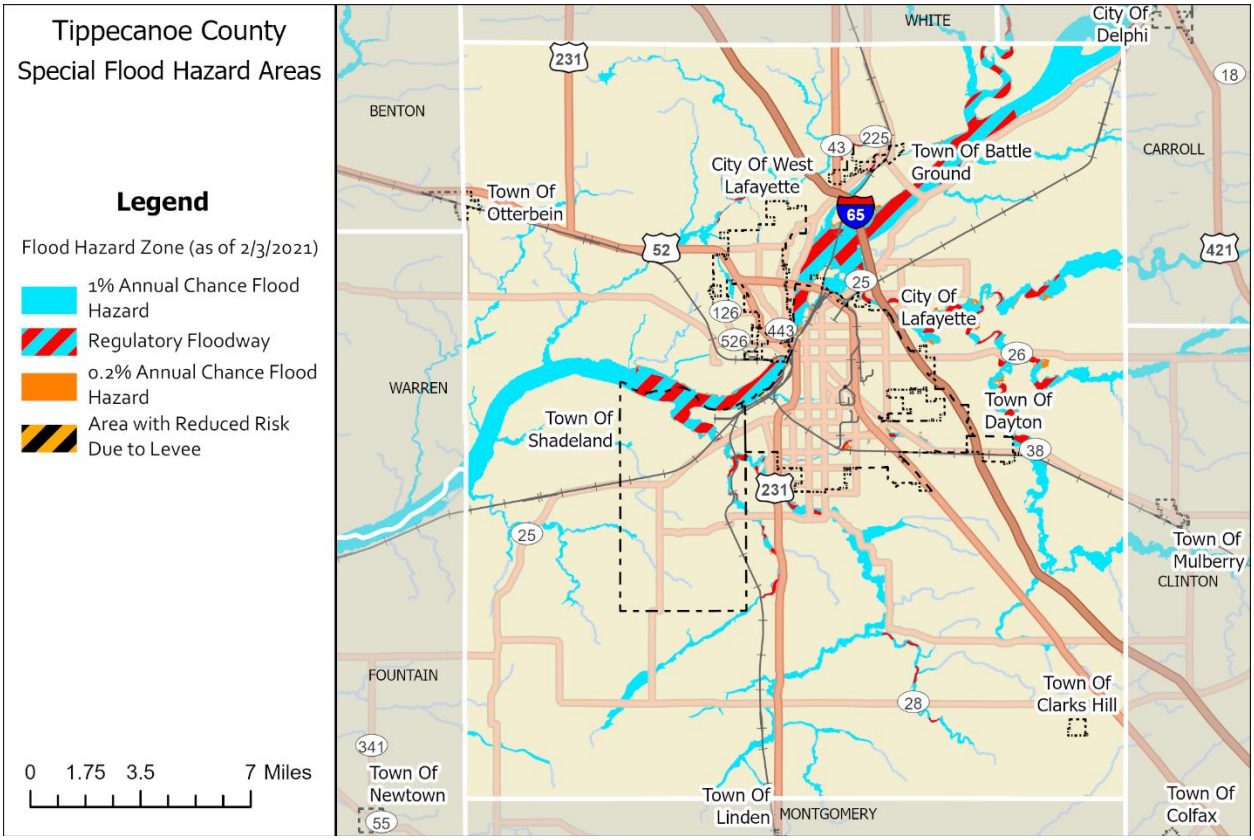

Exhibit 19. Special Flood Hazard Areas (SFHA) in Tippecanoe County

NFIP Analysis

If a structure is in a high-risk area, the 1% annual chance flood hazard, and the owner has a mortgage, they are required to purchase flood insurance through a federally regulated or insured lender. Flood insurance is not federally required in moderate- to low-risk areas, but it is still a good idea. The National Flood Insurance Program (NFIP) is a program in which, if a community enforces a floodplain management ordinance, the federal government will make flood insurance available in order to protect against flood loss.

Since the NFIP plays such a vital role in mitigating flood risk, understanding the status of hazard maps and reported losses occurring can provide insight on new strategies to mitigate the impacts and losses of future events. The communities in Tippecanoe County that participate in the NFIP, their NFIP number, current effective map date, and program entry date are provided in Exhibit 20.

NFIP Community	NFIP Number	Effective Map Date	Join Date
Tippecanoe County	180428	8/15/2017	3/16/1981
City of Lafayette	180253	8/15/2017	11/19/1980
City of West Lafayette	180254	1/2/1981	1/2/1981
Town of Battle Ground	180252	9/25/2009	1/2/1981
Town of Clarks Hill	-	-	-
Town of Dayton	180486	9/25/2009	2/12/1982
Town of Otterbein	-	-	-
Town of Shadeland	180603	8/15/2017	11/1/2012

Exhibit 20. NFIP Participation and Mapping Dates

FEMA provides annual funding through the National Flood Insurance Fund (NFIF) to reduce the risk of flood damage to existing buildings and infrastructure. This grant is the Flood Mitigation Assistance (FMA). The long-term goal is to significantly reduce or eliminate claims under the NFIP through mitigation activities.

FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the National Flood Insurance Program (NFIP), which has suffered flood loss damage on two occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is 25% of the market value of the structure at the time of each flood loss.

The Indiana State NFIP Coordinator and FEMA Region V were contacted to determine the location of repetitive loss structures. As of 2019, FEMA Region V reported 1 structure in Battle Ground, 2 in West Lafayette and 31 in unincorporated Tippecanoe County as Repetitive Loss Structure. Additionally, 5 structures in incorporated areas of the County are Severe Repetitive Loss properties. Exhibit 21 documents the Tippecanoe County NFIP claims data as of 5/31/2018.

Community	Number of Policies	Value of Insurance Claims/Pmts	Total Num. Losses Submitted	Num. Repetitive Losses	Repetitive Losses in Dollars
Tippecanoe County	164	$33,420,800	88	36	$1,823,165
City of Lafayette	34	$7,981,400	-	-	-
City of West Lafayette	22	$8,562,400	4	2	$21,881
Town of Battle Ground	2	$476,500	2	1	$18,950
Town of Clarks Hill	-	-	-	-	-
Town of Dayton	-	-	-	-	-
Town of Otterbein	-	-	-	-	-
Town of Shadeland	1	$120,000	-	-	-

Exhibit 21. NFIP Claims Data for Tippecanoe County

To help understand flood risk, the total structures in the SFHA are compared to the total number of policies in the community. This is based on approximate building locations, and therefore should not be used as an absolute comparison. However, this information may be used to target further mitigation through further engagement with the NFIP. In addition, this may be a tool to help understand if there would be an interest in becoming involved in a discount program with the Community Rating System (CRS). Exhibit 22 provides a comparison of number of buildings in the 1% flood probability boundary to the number of policies, and then provides a percent of insured structures represented by those policies. The last column in the table provides an estimate of the exposure that is insured.

Community	Buildings in 100 Year Floodplain[1]	Exposure of Buildings in Floodplain	Number of Policies	Value of Insurance Claims/Pmts	Approximate Percent of Buildings Insured	Approximate Percent of Exposure Insured
Tippecanoe County	413	$75,011,180	164	$33,420,800	40%	45%
City of Lafayette	60	$15,157,587	34	$7,981,400	57%	53%
City of West Lafayette	19	$4,560,705	22	$8,562,400	116%	188%

[1] The count and exposure of buildings in the floodplain reported in this table is based on an account of all structures in the floodplain that were represented in the county property assessment data.

Town of Battle Ground	11	$1,527,071	2	$476,500	18%	31%
Town of Clarks Hill	0	$0	-	-	-	-
Town of Dayton	0	$0	-	-	-	-
Town of Otterbein	0	$0	-	-	-	-
Town of Shadeland	10	$1,944,626	1	$120,000	10%	6%

Exhibit 22. Comparison of Estimated Building Exposure to Insured Buildings

3.3.1.6 Vulnerability Analysis for Flash Flooding

Flash flooding could affect any location within this jurisdiction; therefore, the entire county's population and buildings are vulnerable to a flash flood. These structures can expect the same impacts as discussed in a riverine flood.

3.3.1.7 Hazus-MH Analysis Using 100 Year (1% chance) Flood Boundary

Hazus-MH was used to estimate the damages incurred for a 1% annual chance flood event in Tippecanoe County using the SFHA and a 10-meter DEM (digital elevation model) to create a flood depth grid. Hazus-MH was then used to perform a user-defined facility (UDF) analysis of Tippecanoe County. The UDFs were defined by intersecting the Hazus-MH generated flood depth grid with the Tippecanoe County building inventory. These data were then analyzed to determine the depth of water at the location of each building point and then related to depth damage curves to determine the building losses for each structure.

Hazus-MH estimates the SFHAs would damage 513 buildings county-wide at a cost of almost $100 million. In the modeled scenario, the unincorporated areas of Tippecanoe County contained the most damaged buildings but the town or city with the most damage was the City of Lafayette, with 60 buildings damaged at a cost of almost $15 million. The total estimated numbers and cost of damaged buildings by community are given in Exhibit 23. Exhibit 25 depicts the Tippecanoe County buildings that fall within the SFHA. Exhibit 26 through Exhibit 29 display community maps of buildings that fall within the SFHA.

Community	Total Buildings Damaged	Building Occupancy Class						
		Agr.	Comm.	Educ.	Govt.	Ind.	Rel.	Res.
County	413	44	6	-	2	2	3	356
Lafayette	60	-	8	-	1	1	3	47
West Lafayette	19	-	-	-	-	-	-	19
Battle Ground	11	-	-	-	-	-	-	11
Clarks Hill	0	-	-	-	-	-	-	-

Dayton	0	-	-	-	-	-	-	-
Otterbein	0	-	-	-	-	-	-	-
Shadeland	10	4	-	-	-	-	-	6

Exhibit 23. Estimated Number of Buildings Damaged by Community and Occupancy Class

Community	Cost Buildings Damaged	Building Occupancy Class						
		Agr.	Comm.	Educ.	Govt.	Ind.	Rel.	Res.
County	$75,011,180	$8,513,165	$2,728,699	-	$573,458	$2,194,097	$2,880,289	$58,121,471
Lafayette	$15,157,587	-	$2,131,198	-	$286,729	$1,097,049	$2,008,325	$9,634,286
West Lafayette	$4,560,705	-	-	-	-	-	-	$4,560,705
Battle Ground	$1,527,071	-	-	-	-	-	-	$1,527,071
Clarks Hill	$0	-	-	-	-	-	-	-
Dayton	$0	-	-	-	-	-	-	-
Otterbein	$0	-	-	-	-	-	-	-
Shadeland	$1,944,625	$755,184	-	-	-	-	-	$1,189,441

Exhibit 24. Estimated Cost of Buildings Damaged by Community and Occupancy Class

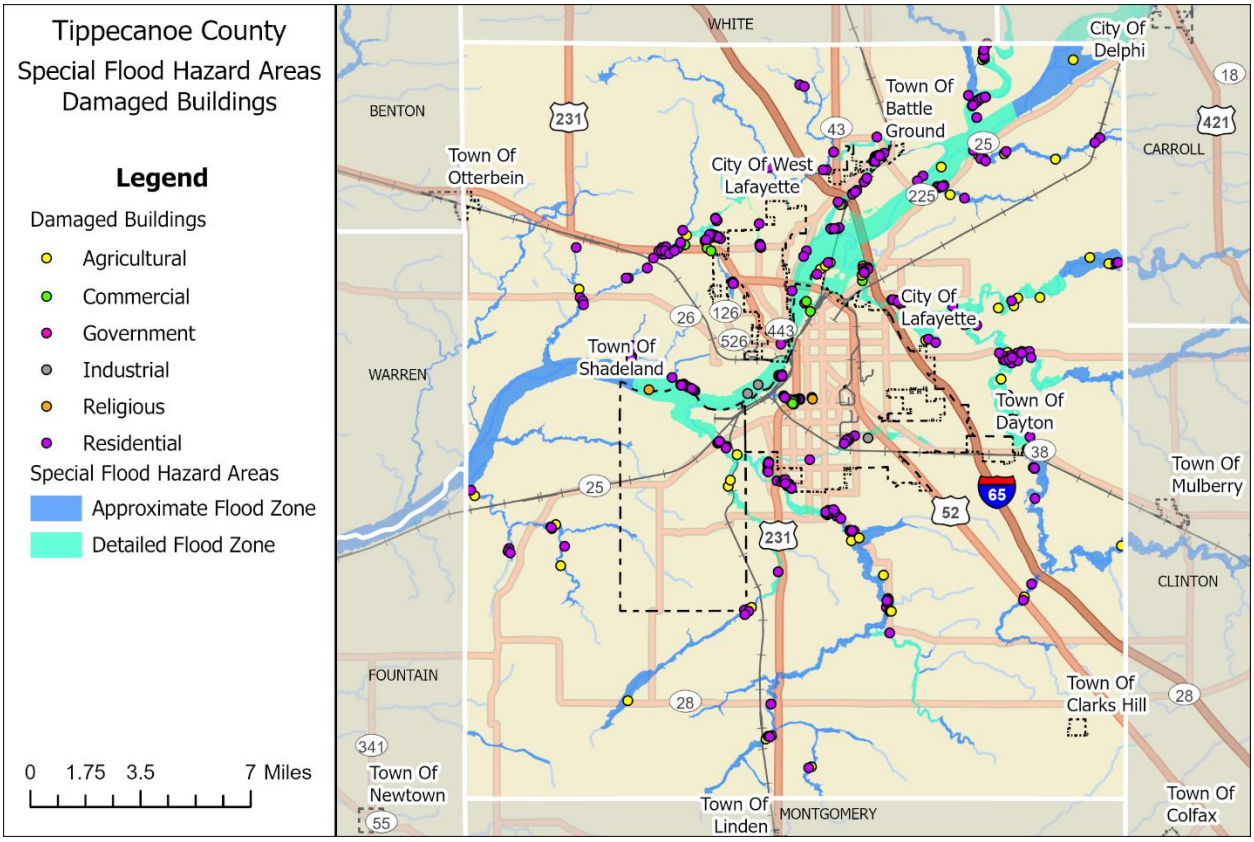

Exhibit 25. Estimated Buildings Damaged in SFHA (Tippecanoe County)

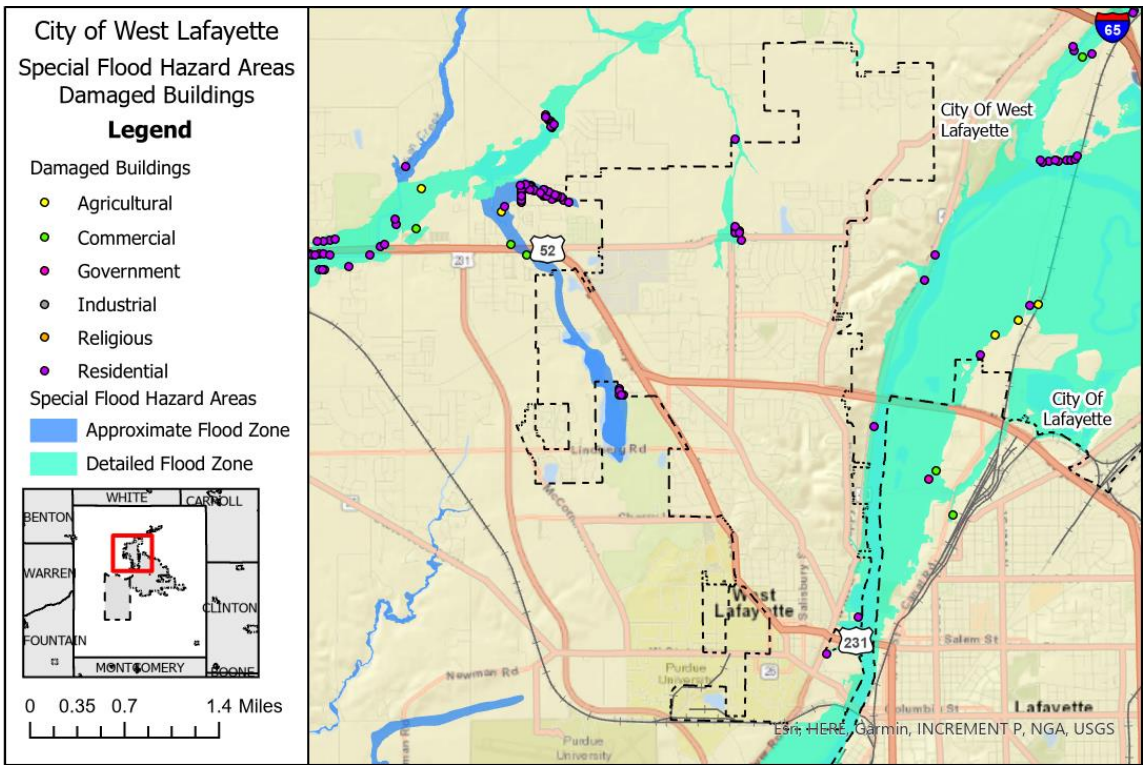

Exhibit 26. Estimated Buildings Damaged in SFHA, Displayed by Occupancy Code (West Lafayette)

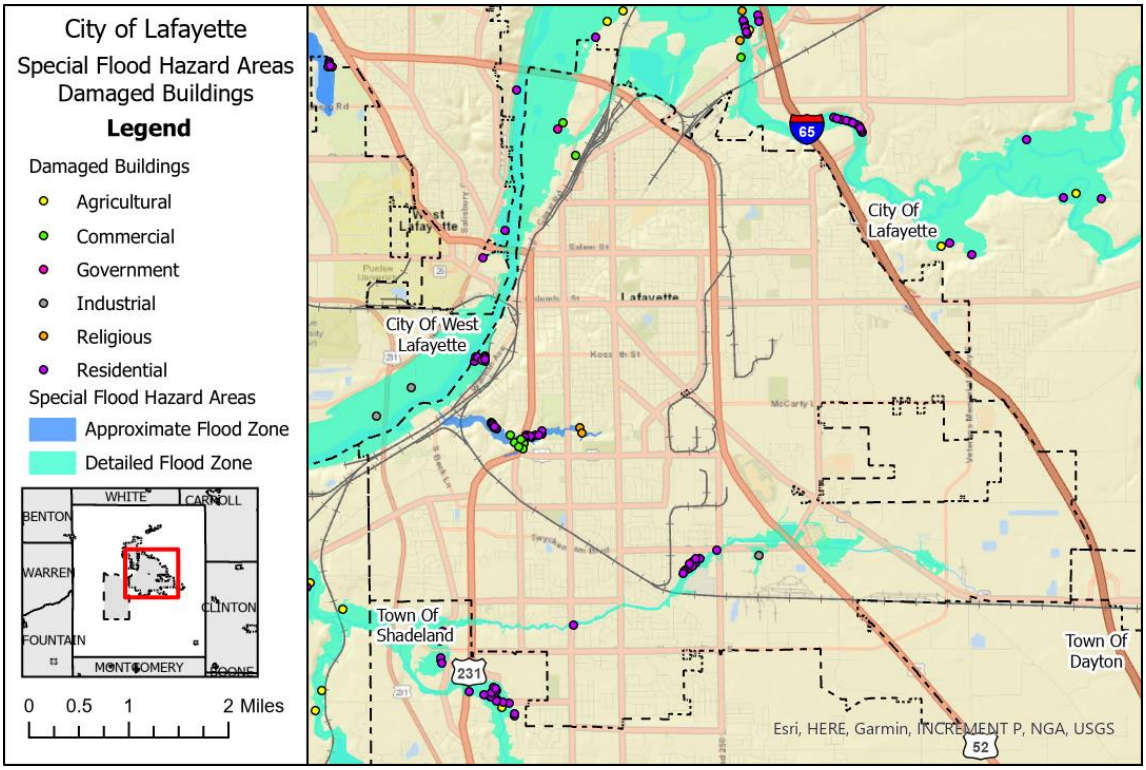

Exhibit 27. Estimated Buildings Damaged in SFHA, Displayed by Occupancy Code (Lafayette)

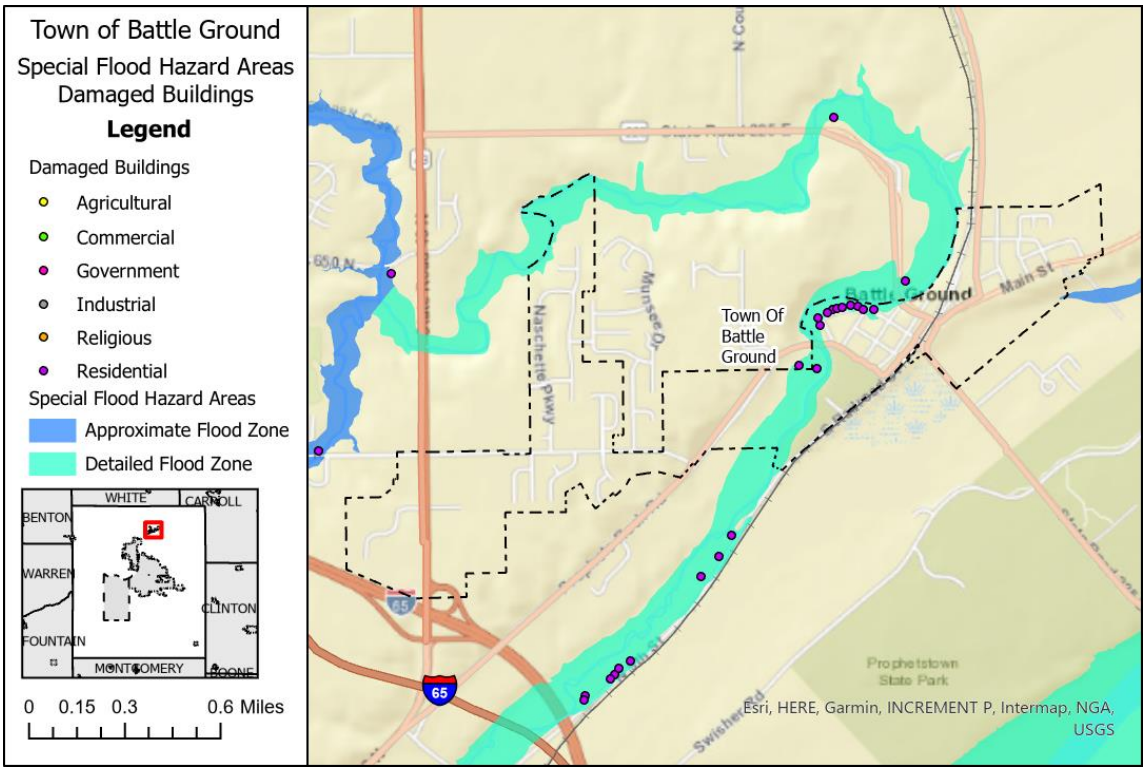

Exhibit 28. Estimated Buildings Damaged in SFHA, Displayed by Occupancy Code (Battle Ground)

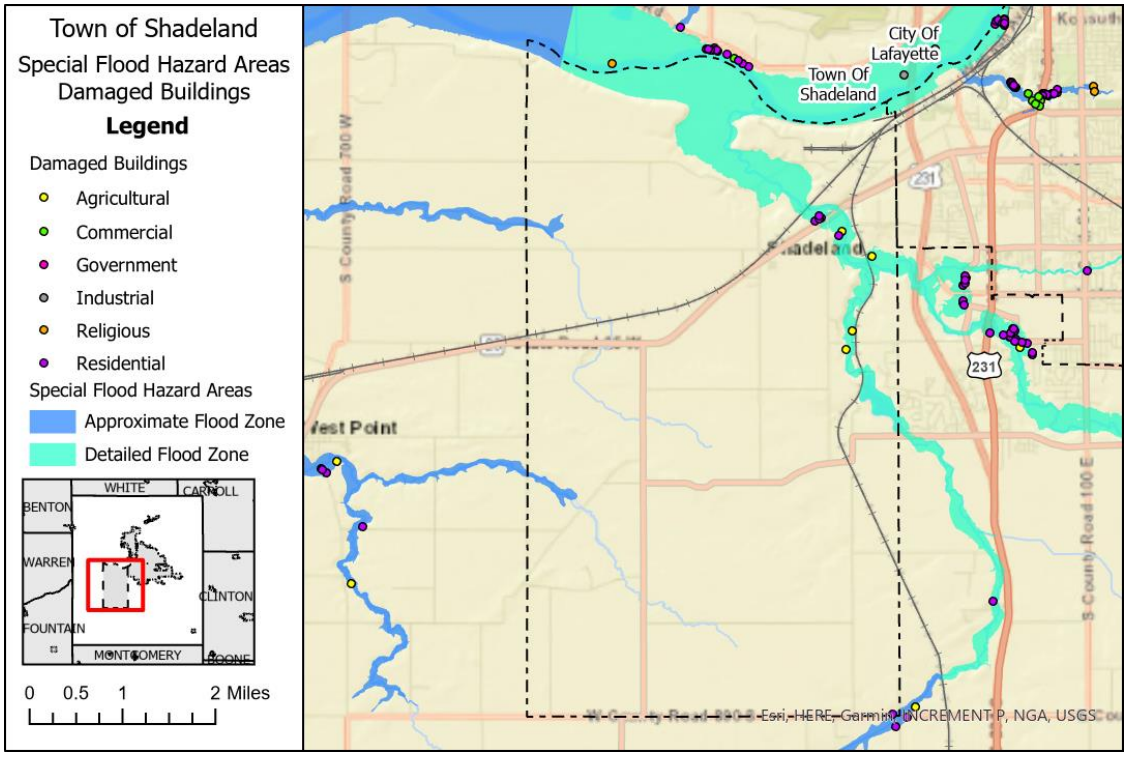

Exhibit 29. Estimated Buildings Damaged in SFHA, Displayed by Occupancy Code (Shadeland)

Overlay Analysis of Essential and Critical Facilities

Essential and other critical facilities can become damaged during the 1% annual chance flood. Damages to these types of facilities can severely impact the ability of the community to respond and recover from disasters. Damaged facilities located within towns or cities have been mapped in the following figures. In Tippecanoe County, only one essential facility, the Wea Township Volunteer Fire Department, is in the 1% annual chance flood. Multiple critical facilities are in the 1% annual chance flood: 2 wastewater facilities, 2 hazardous materials facilities, and 165 highway bridges. The wastewater and hazardous materials facilities are listed in Exhibit 30.

Facility Type	Name	Address	City
Wastewater Facility	American Suburban Utilities Inc	4100 Bridgeway Drive	West Lafayette
Wastewater Facility	Battle Ground WWTP	6301 Prophets Rock Rd	Battle Ground
Hazardous Materials	Tippecanoe Labs	1650 Lilly Rd.	Lafayette
Hazardous Materials	Carriage Estates II	4100 Bridgeway Dr	West Lafayette

Exhibit 30. Essential and Critical Facilities in 1% Annual Chance Flood

3.3.1.8 IDNR Best Available Data Layer

The IDNR's Division of Water created a dataset for Indiana that incorporates the detailed-level floodplain data in the FEMA FIRMs and enhanced it with a lower level, but still quality, floodplain data for the majority of all streams in the state known as the "best available" floodplain layer. FEMA's dataset remains the official dataset of the NFIP; the "best available" layer assists in

floodplain management applications and determining limits of jurisdiction for the Indiana Flood Control Act. The map in Exhibit 31 was created using the best available data layer from IDNR along with the county's building inventory. To show the possible buildings affected in the best available layer, only the buildings within the flood boundary have been mapped. A comparison of the damaged buildings for both the regulated SFHA and the DNR best available data are listed in Exhibit 32. Exhibit 33 compares the exposure cost for the estimated buildings damaged in both the regulated SFHA and the IDNR best available data layer.

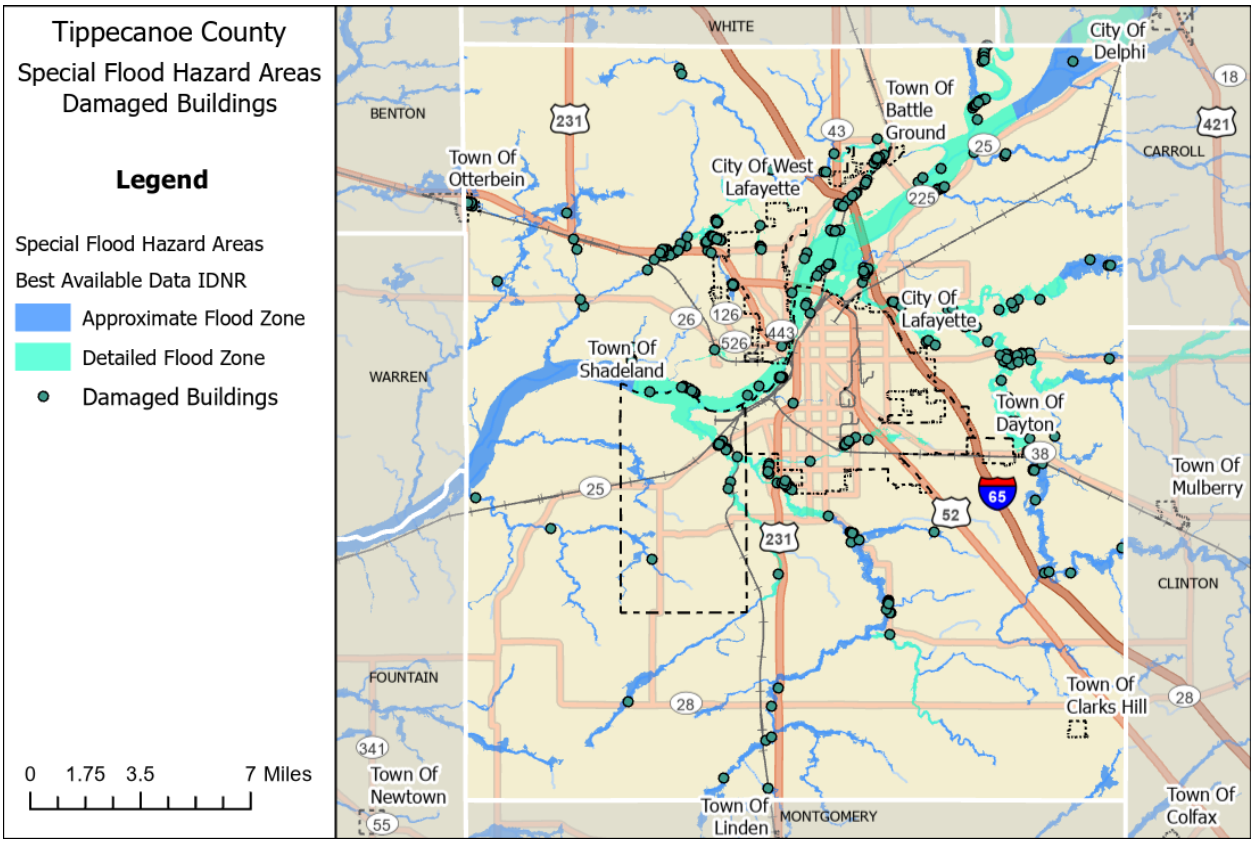

Exhibit 31. Estimated Buildings Damaged in IDNR Best Available Data

	Total Buildings Damaged	Building Occupancy Class						
		Agr.	Comm.	Educ.	Govt.	Ind.	Religious	Res.
FEMA SFHA	513	48	14	-	3	3	6	403
DNR Best Available	449	45	11	-	2	4	5	382

Exhibit 32. Estimated Number of Buildings Damaged by Community and Occupancy Class

	Cost Buildings Damaged	Building Occupancy Class						
		Agr.	Comm.	Educ.	Govt.	Ind.	Religious	Res.

FEMA SFHA	$98,201,168	$9,268,349	$4,859,898	-	$860,186	$3,291,145	$4,888,614	$75,032,975
DNR Best Available	$84,513,976	$8,597,745	$4,539,784	-	$573,457	$4,388,194	$3,928,518	$66,414,796

Exhibit 33. Estimated Exposure Cost of Buildings Damaged by Community and Occupancy Class

3.3.1.9 Community Development Trends and Future Vulnerability

Controlling floodplain development is the key to reducing flood-related damages. Areas with recent development within the county may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible. Damage to these can cause the backup of water, sewage, and debris into homes and basements, causing structural and mechanical damage as well as creating public health hazards and unsanitary conditions.

Another key strategy in natural hazard mitigation is the conversion of frequently flooded land to wetlands. Wetlands promote human well-being in many ways including improvements to water purification, increased water supply, climate regulation, flood regulation, and opportunities for recreation and tourism. According to a report by the US EPA, a one-acre wetland can store approximately three-acre feet of water, which is equal to one million gallons. Furthermore, trees and other wetland vegetation slow the speed of flood waters, ultimately lowering flood heights and naturally mitigating potential flood-related destruction.

Flash flooding could affect any location within this jurisdiction; therefore, the entire county's population and buildings are vulnerable to a flash flood. These structures can expect the same impacts as discussed in a riverine flood.

3.3.1.10 Relationship to other Hazards

Severe storms and blizzards – Summer storms lead to logjams, and snowmelt can contribute to flooding and, under the right circumstances, flash flooding.
Dam Failure – Flood events can compromise the structural integrity of dams.
Public Health – Public health can be affected as a result of wastewater spills due to flooding or power failures.
Water Main Breaks – Surges in water pressure as a result of water pumps starting after power outages can lead to water main breaks.

3.3.2 Earthquake

3.3.2.1 Hazard Definition for Earthquake

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free, causing the ground to shake. Ninety-five percent of earthquakes occur at the plate boundaries; however, some earthquakes occur in the middle of plates, as is the case for seismic zones in the Midwestern US.

Ground shaking and tremors from strong earthquakes can collapse buildings and bridges; disrupt gas, electric, and communication (e.g. phone, cable, Internet) services; and sometimes trigger landslides, flash floods, and fires. Buildings with foundations resting on unconsolidated landfill and other unstable soil and trailers or homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

Magnitude, which is determined from measurements on seismographs, measures the energy released at the source of the earthquake. Intensity measures the strength of shaking produced by the earthquake at a certain location and is determined from effects on people, human structures, and the natural environment. Exhibit 34 and 35 list earthquake magnitudes and their corresponding intensities.

Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Exhibit 34. Abbreviated Modified Mercalli Intensity Scale

Earthquake Magnitude	Typical maximum Modified Mercalli Intensity
1.0 – 3.0	I
3.0 – 3.9	II – III
4.0 – 4.9	IV – V
5.0 – 5.9	VI – VII
6.0 – 6.9	VII – IX
7.0 and higher	VIII or higher

Exhibit 35. Earthquake Magnitude vs. Modified Mercalli Intensity Scale

3.3.2.2 Earthquake History in Tippecanoe County

The most seismically active area in the Central US is referred to as the New Madrid Seismic Zone. Scientists have learned that the New Madrid fault system may not be the only fault system in the central US capable of producing damaging earthquakes. The Wabash Valley Fault System in Indiana shows evidence of large earthquakes in its geologic history, and there may be other currently unidentified faults that could produce strong earthquakes.

At least 47 earthquakes, M3.0 or greater, have occurred in Indiana since 1817. The last such event in Indiana was a M3.8 centered northeast of Montezuma on June 17, 2021. Most of the seismic activity in Indiana occurs in the southwestern region of the state. Earthquakes originate just across the boundary in Illinois and can be felt in Indiana. Exhibit 36 Shows the historical earthquakes in the state of Indiana.

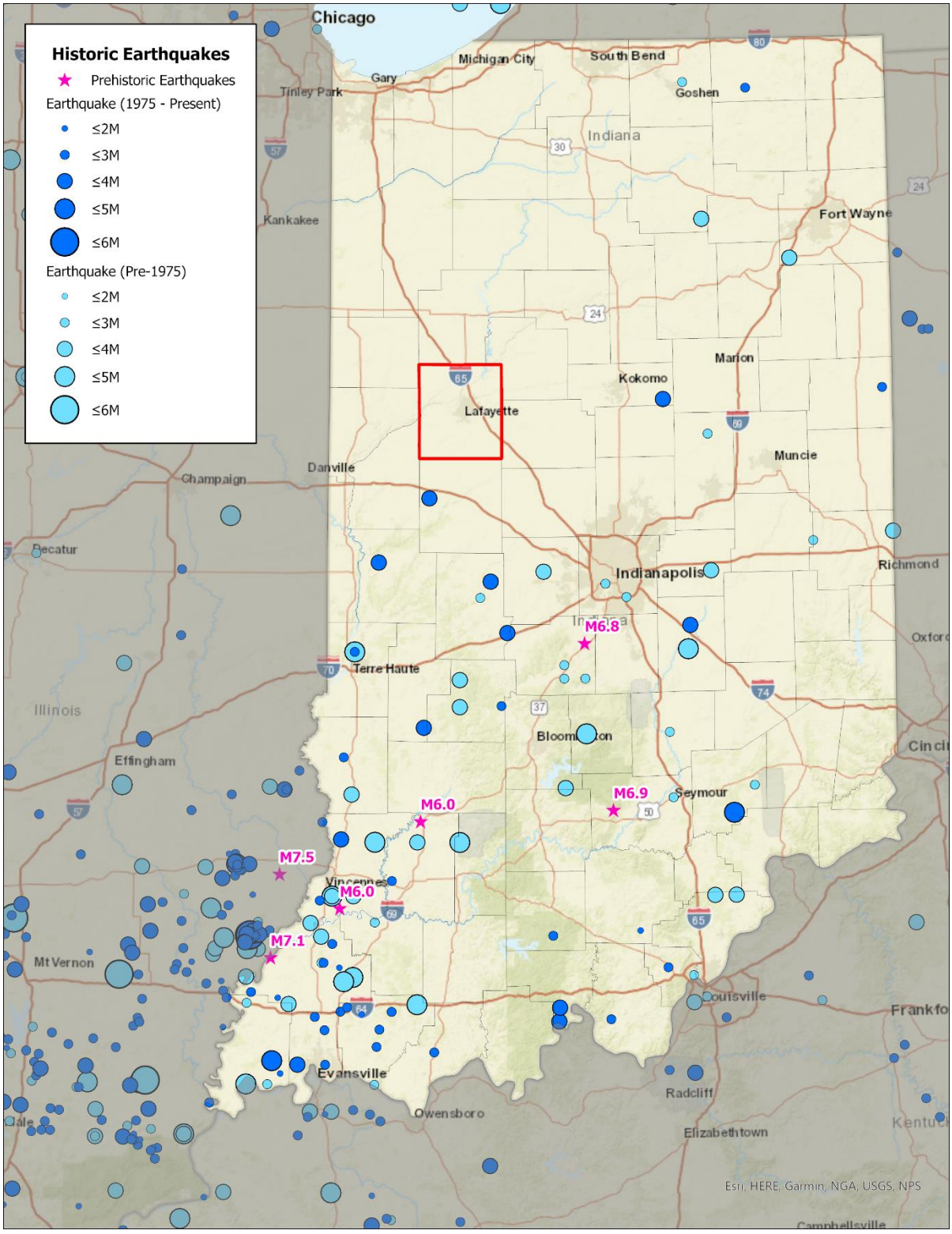

Exhibit 36. Indiana Earthquake Epicenters Map

3.3.2.3 Geographic Location for Earthquake

Tippecanoe County occupies a region susceptible to two earthquake threats: the threat of an earthquake along the Wabash Valley Fault System and the threat of an event near Anna in Shelby County Ohio. Return periods for large earthquakes within the New Madrid System are estimated to be 500 years. Moderate quakes between magnitude 5.5 and 6.0 can recur within approximately 150 years or less. The Wabash Valley Fault System is a sleeper that threatens the southwest quadrant of the state and may generate an earthquake large enough to cause damage as far north and east as Central Michigan.

3.3.2.4 Hazard Extent for Earthquake

The extent of the earthquake is countywide. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. A National Earthquake Hazards Reduction Program (NEHRP) compliant soils map was used for the analysis which was provided by IGS. The map identifies the soils most susceptible to failure and ranks their liquefaction potential. Tippecanoe County is primarily made up of soils ranking as moderate potential for liquefaction. Exhibit 37 shows the state and county potential for liquefaction.

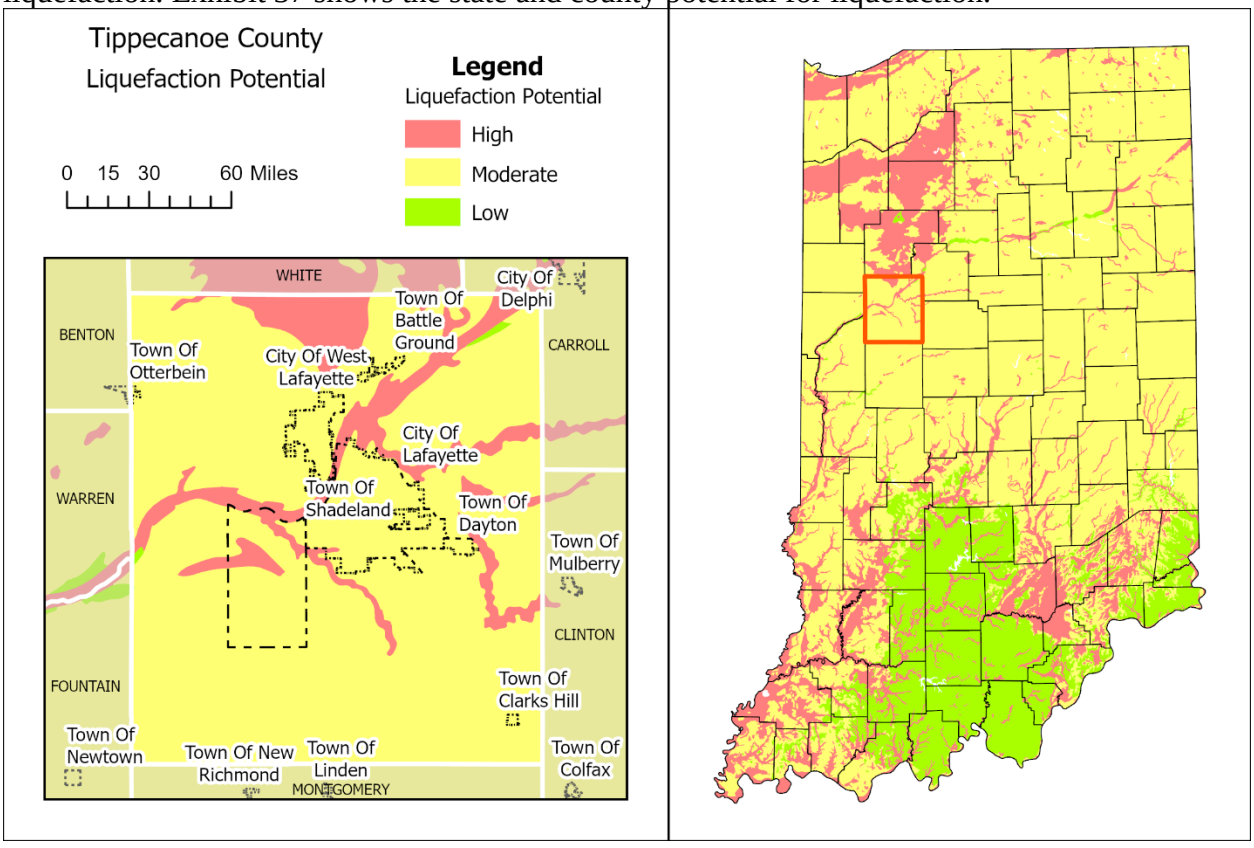

Exhibit 37. NEHRP State of Indiana Liquefaction Potential

3.3.2.5 Vulnerability Analysis for Earthquake

During an earthquake, the types of infrastructure that could be impacted include roadways, runways, utility lines and pipes, railroads, and bridges. Because an extensive inventory of the

infrastructure is not available to this plan, it is important to emphasize that any number of these structures could become damaged in the event of an earthquake. The impacts to these structures include broken, failed, or impassable roadways and runways; broken or failed utility lines, such as loss of power or gas to a community; and railway failure from broken or impassable tracks. Bridges also could fail or become impassable, causing traffic risks, and ports could be damaged, which would limit the shipment of goods. Typical scenarios are described to gauge the anticipated impacts of earthquakes in the county in terms of numbers and types of buildings and infrastructure. Hazus-MH for Earthquake Analysis model estimates damages and loss of buildings, lifelines, and essential facilities from deterministic and probabilistic scenarios.

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. The building damage total loss amount is developed by the building inventory attributes inputs. Depending on the material of construction, type of foundation, year of construction, are the key factors that dictate the expense in rebuilding.

Three events were modeled. The first scenario is the New Madrid Scenario. This event represents a large-magnitude, high-impact regional event situated in the Mississippi Valley region approximately 100 miles from the southwestern corner of the state. The magnitude of this event (M7.6) approximates the size of the largest of the three earthquakes in the 1811-1812 New Madrid sequence. The second scenario is the Wabash Valley Scenario. This event represents a "worst case" scenario of a large-magnitude (M7.3) event occurring along the Wabash Valley fault system, just outside the state of Indiana in southeastern Illinois. The model uses a liquefaction data map in order to account for the local soil conditions for estimating ground motion and liquefaction. The third scenario is a 500-year probabilistic scenario, which seeks to represent the cumulative hazard facing each area of the state based on a probabilistic likelihood of ground shaking associated with all the sources that could potentially affect a given area. In principle, this analysis evaluates the average impacts of a multitude of possible earthquake sources with a magnitude that would be typical of that expected for a 500-year return.

The Building Damage Summary by Earthquake Event Exhibit displays damages for all three scenarios run by Hazus-MH. In addition to the dollar amount of losses, the table displays the number of buildings damaged and to what extent. Exhibit 39 through 41 display the Earthquake Scenarios total losses for each scenario broken down by census tract.

Exhibit 38. Building Damage Summary by Earthquake Event

Scenario	Total Loss in Dollars	Moderate	Extensive	Complete
New Madrid (M7.6)	$50.3 Million	24	1	0
Wabash Valley (M7.3)	$49.2 Million	123	9	0
Probabilistic (500-Year)	$50.0 Million	52	4	0

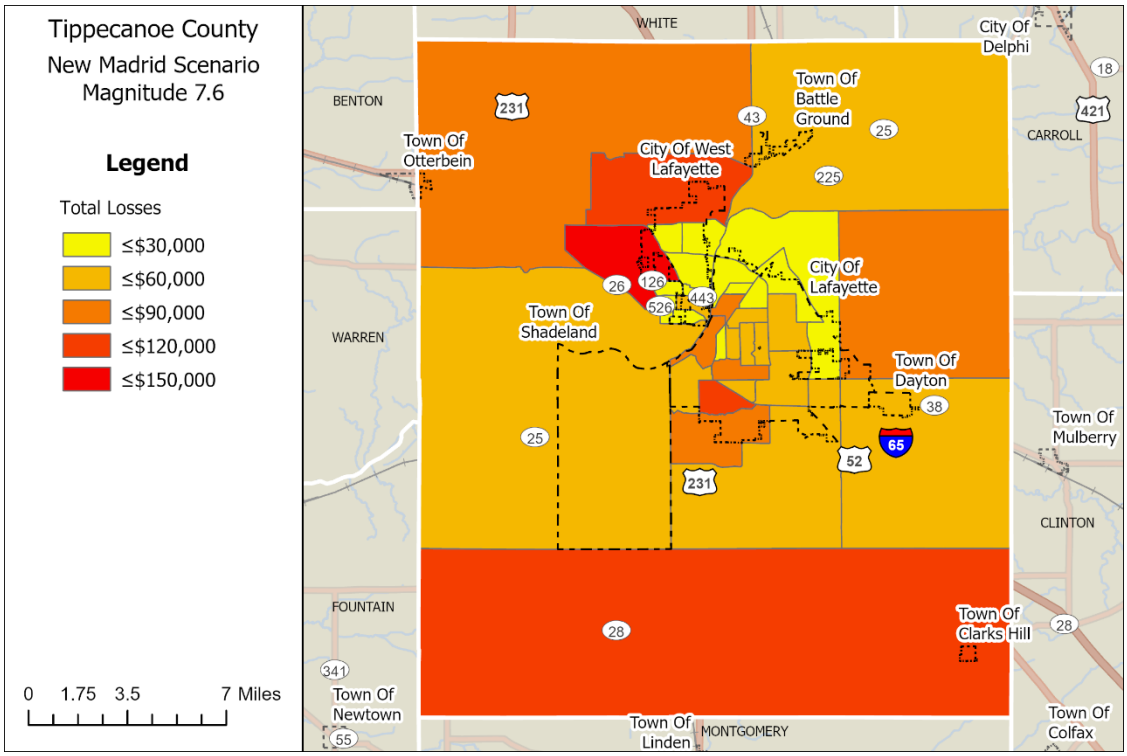

Exhibit 39. New Madrid Earthquake Scenario – Total Losses

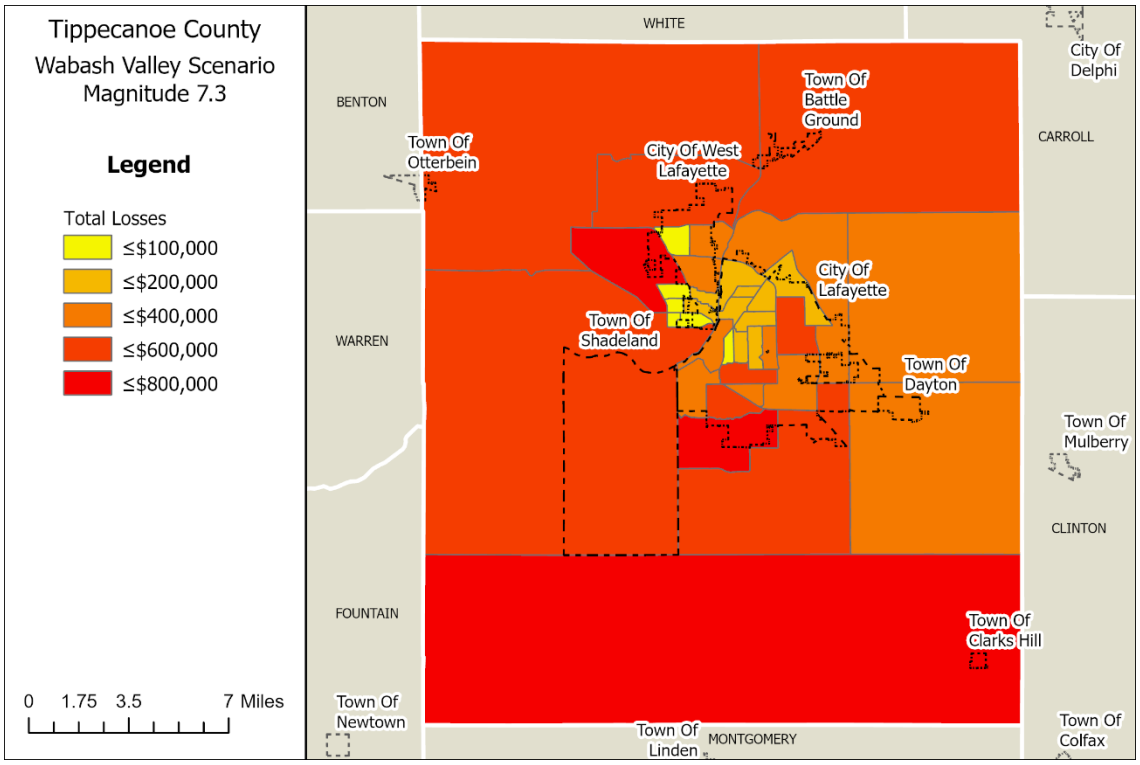

Exhibit 40. Wabash Valley Earthquake Scenario – Total Losses

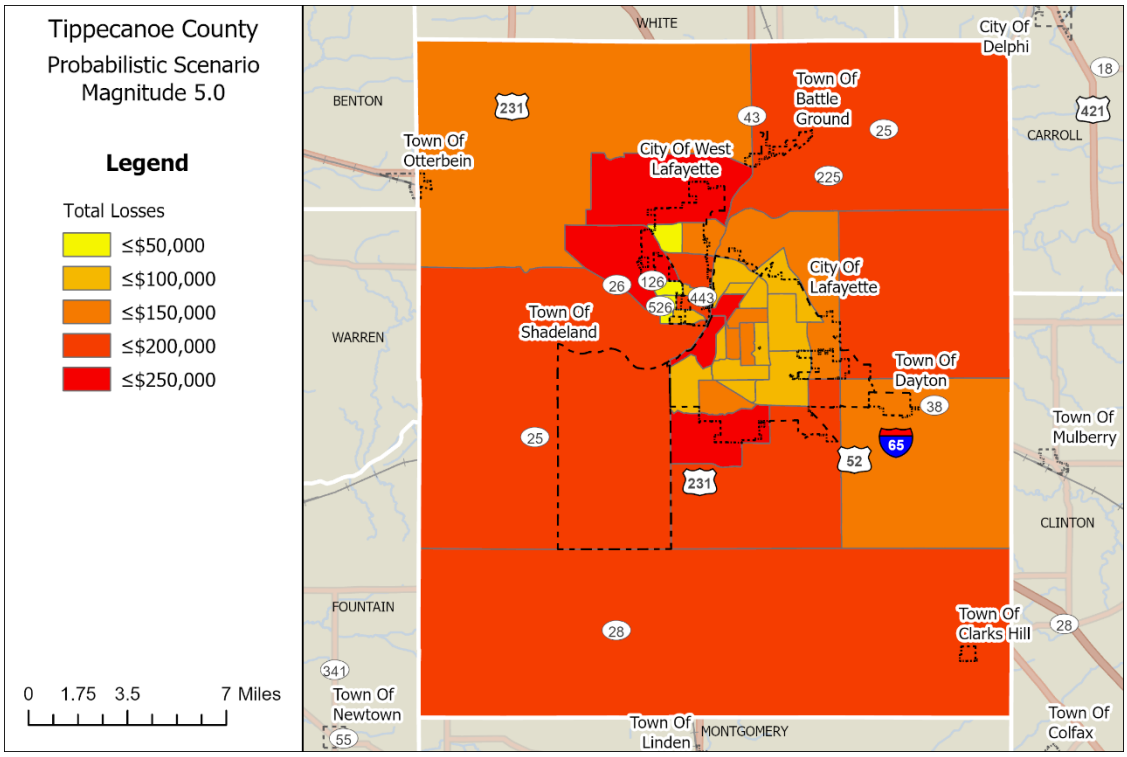

Exhibit 41. 500-Year Probabilistic Earthquake Scenario – Total Losses

3.3.2.6 Community Development Trends and Future Vulnerability

Community development is planned to occur outside of the low-lying areas in floodplains with a water table within five feet of grade that is susceptible to liquefaction. New construction, especially critical facilities, will accommodate earthquake mitigation design standards.

The possibility of the occurrence of a catastrophic earthquake in the central and eastern United States is real as evidenced by history and described through this section. The impacts of significant earthquakes affect a large area, terminating public services and systems needed to aid the suffering and displaced. These impaired systems are interrelated in the hardest struck zones. Power lines, water and sanitary lines, and public communications may be lost; highways, railways, rivers, and ports may not allow transportation to the affected region. Furthermore, essential facilities such as fire and police departments and hospitals, may be disrupted if not previously improved to resist earthquakes.

As with hurricanes, mass relocation may be necessary, but the residents who are suffering from the earthquake can neither leave the heavily impacted areas nor receive aid or even communication in the aftermath of a significant event.

3.3.2.7 Relationship to other Hazards

Ground Failure- According to the National Academies of Sciences Engineering Medicine, the major cause of earthquake damage is ground failure. Some ground failures induced by earthquake are the result of liquefaction of saturated sands and silts, the weakening of sensitive clays, or by

the crumbling and breaking away of soil and rock on steep slopes. Ground failure has been known to cause buildings to collapse and to severely hinder communication and transportation systems.
Utility Failure- Earthquakes frequently damage utilities, particularly underground facilities and older storage tanks, but nearly every utility can be vulnerable to the shaking that earthquakes induce. Seismic damage to buried utilities are often influenced by ground conditions and subsurface strain distribution. Since utilities are typically part of a larger network system, damages to key locations in a network can potentially set off a chain reaction that affects significant portions of the utility system. Earthquake damage to utilities can also potentially create secondary hazards such as fires or hazmat situations since some utilities may handle volatile or flammable substances.

3.3.3 Ground Failure

3.3.3.1 Hazard Definition for Ground Failure

Indiana has three types of ground failure. Ground failure is a general reference to landslides, fluvial erosion, and subsidence to include karst sinkholes, and underground coal mine collapse.

Landslides

Landslides are a serious geologic hazard common to almost every state in the US. It is estimated that, nationally, they cause up to $2 billion in damages and from 25 to 50 deaths annually. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year.
The term landslide is a general designation for a variety of downslope movements of earth materials. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. The main causes of landslides include:

- Significant ground vibration
- Slope failure due to excessive downward movement (gravity)
- Groundwater table changes (often due to heavy rains)

Preventive and remedial measures include modifying the landscape of a slope, controlling the groundwater, constructing tie backs, spreading rock nets, etc. The expansion of urban and recreational development into hillside areas has resulted in an increasing number of properties subject to damage as a result of landslides. Landslides commonly occur in connection with other major natural disasters such as earthquakes, wildfires, and floods.

Karst

Southern Indiana has a network of underground caves formed by the natural physical interaction of groundwater with its bedrock, forming what is known as karst landscape. According to the Indiana Geological & Water Survey, karst topography is a distinctive type of landscape largely shaped by the dissolving action of groundwater, which is naturally acidic, on carbonate bedrock, which in this area is mostly limestone. This geological process, which takes thousands of years, is characterized by unique features such as sinkholes, fissures, caves, disappearing streams, springs, rolling topography, and underground drainage systems. Structures built above a karst formation could potentially be subject to land subsidence and collapse into a resulting sinkhole.

Underground Coal Mines

According to the Indiana Geological Survey's GIS Atlas, there are areas of underground coal mines which could lead to ground failure. Roof failure has always been a major concern in underground coal mining. A majority of underground mines in southwest Indiana are older mines since abandoned and thus susceptible to collapse.

Fluvial Erosion

Streams naturally migrate (change course and move laterally) over time, this movement is called a Fluvial Erosion Hazard (FEH). The rate and intensity of movement is dependent upon many factors including drainage area, geology, and human actions. FEH represents a significant concern in areas where human development and infrastructure, are established in close proximity to natural waterways. In mild cases, this may be seen as the gradual loss of a farm field or the undermining of a fence row when gradual channel migration consumes private land. In more severe cases, the FEH risk may threaten properties and/or structures to the degree that they become uninhabitable or even lost to natural channel processes.

3.3.3.2 Ground Failure History in Tippecanoe County

The planning committee did not identify any major ground failure events including landslide and land subsidence events.

3.3.3.3 Geographic Location for Ground Failure

The geographic location for ground failure varies depending on the type of ground failure. Karst areas for Tippecanoe County are mapped in Exhibit 42.

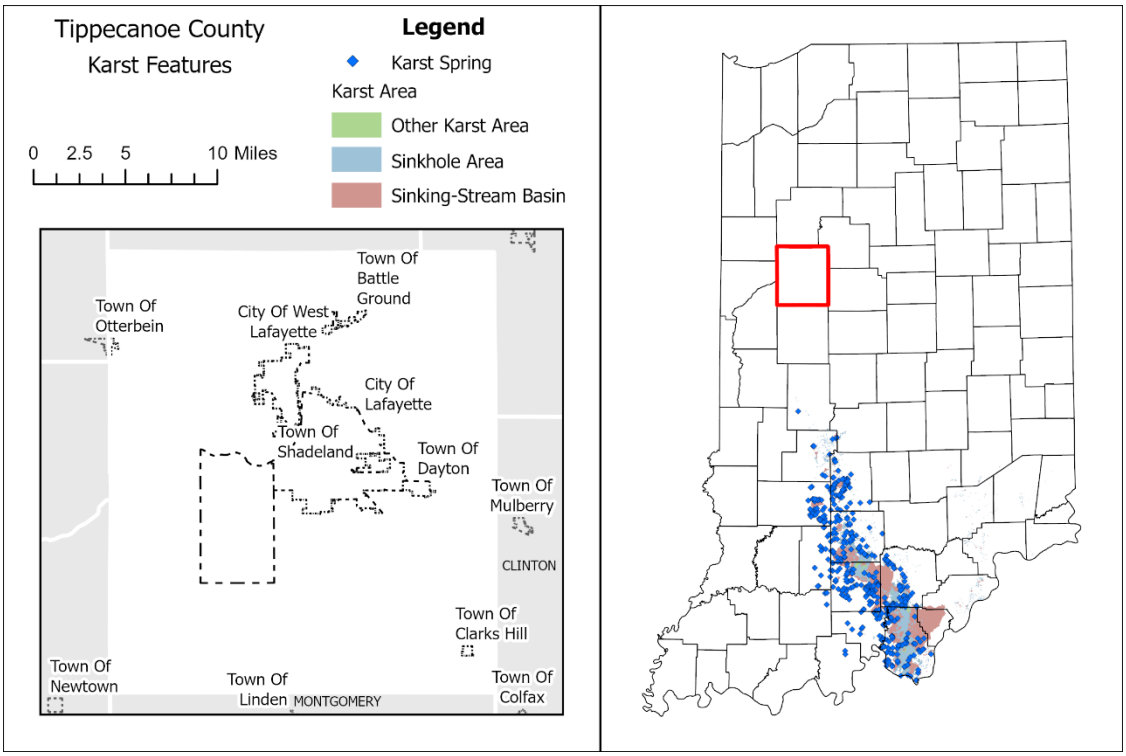

Exhibit 42. Tippecanoe County Karst Features

A 2015 study by the Indiana Geological & Water Survey determined the probability of sinkhole formation throughout southern Indiana. Their analysis is based on the density of known sinkholes, as well as several geologic, topographic, and hydrologic variables that indicate the future vulnerability to sinkhole formation. Exhibit 43 shows the results of this study, showing that areas with the highest probability of sinkhole development generally occur throughout central southern Indiana, with less chance of sinkhole occurrence toward the eastern and western parts of southern Indiana.

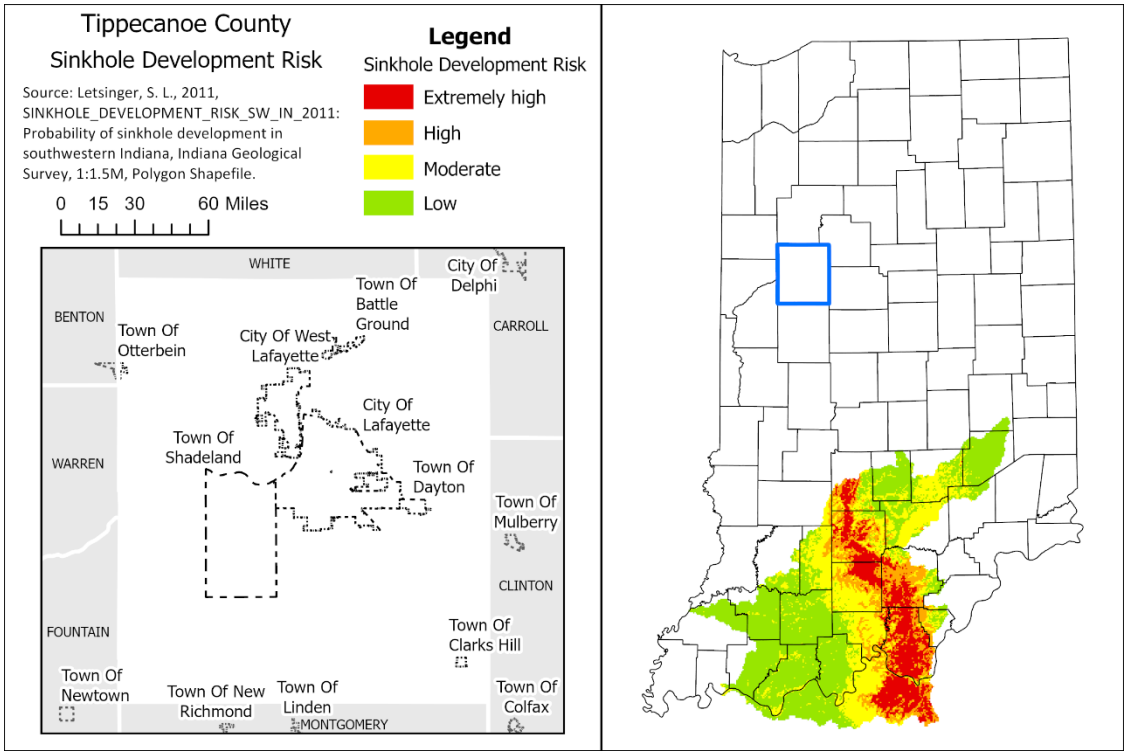

Exhibit 43. Risk of Sinkhole Development

Coal mines in Tippecanoe County are illustrated in Exhibit 44. No underground or surface coal mines were found in the county.

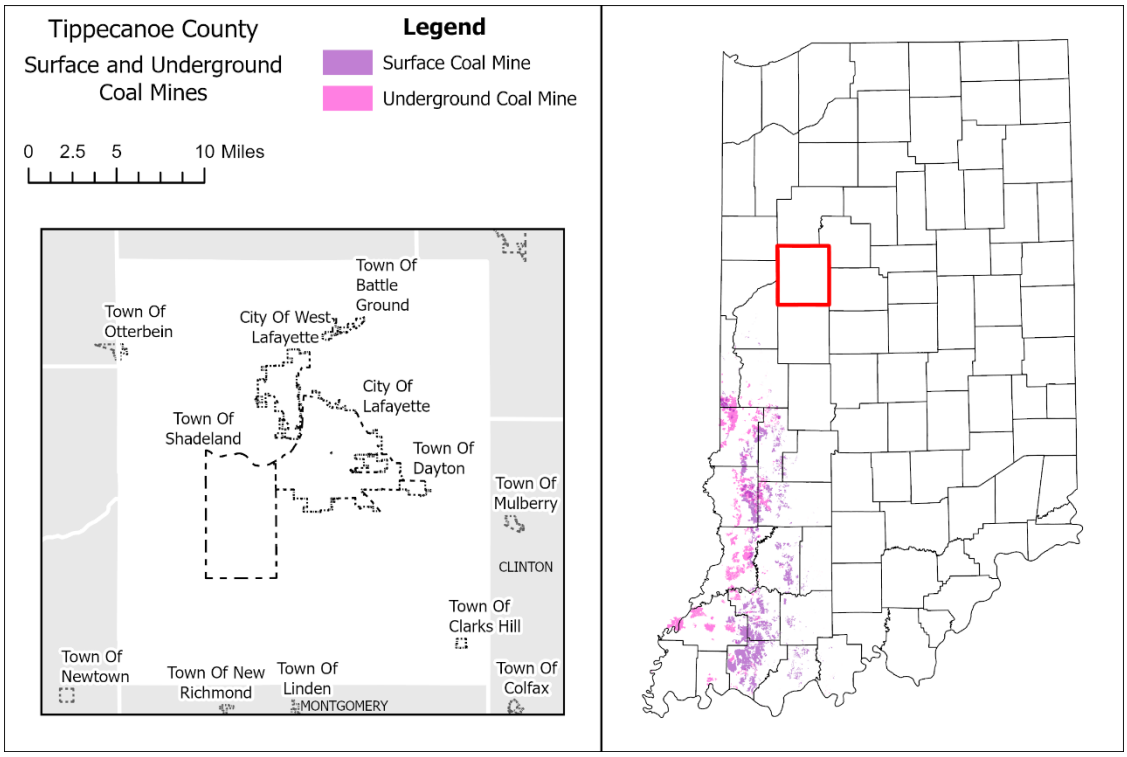

Exhibit 44. Surface and Underground Coal Mines

Exhibit 45 highlights streams found to be "actively migrating" which can indicate an increased FEH risk. Streams in the eastern portion of the state are actively migrating and could lead to fluvial erosion. These are along Wildcat Creek, Middle Fork Wildcat Cree, and South Fork Wildcat Creek.

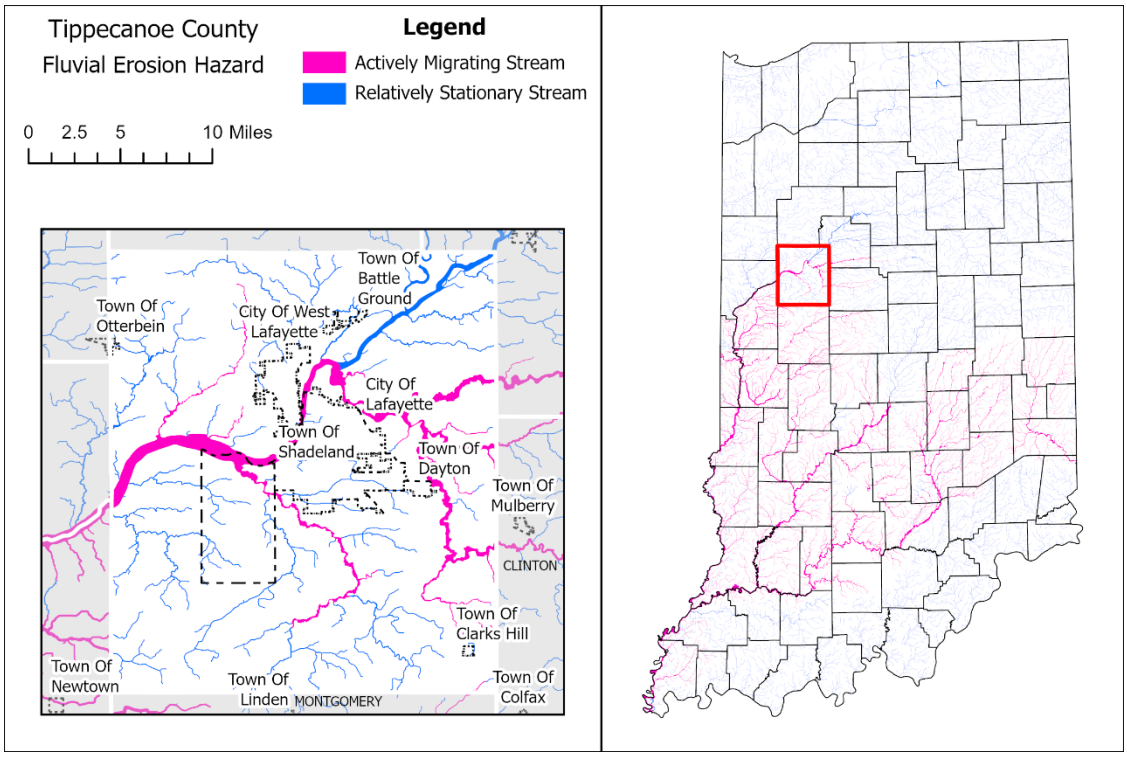

Exhibit 45. Tippecanoe County FEH Risk

3.3.3.4 Hazard Extent for Ground Failure

The extent of the ground failure hazard is closely related to development near the regions that are at risk. The extent will vary within these areas depending on the potential of elevation change, as well as the size of the underground structure. The hazard extent of ground failure is related to various concentrated areas as shown on the maps.

3.3.3.5 Vulnerability Analysis for Ground Failure

The US Geological Survey's Landslide Overview Map of the Conterminous United States shows two large zones in south-central Indiana as having moderate susceptibility for landslides, but with low incidence of landslides. In contrast, the majority of northern Indiana has a very low (less than 1.5% of the area involved) incidence of landslides and only the northwest is shown as having a moderate level of susceptibility. The county has a low incidence of landslides. As seen in USGS Landslide Overview Map (Exhibit 46), Tippecanoe County predominantly lies in the low landslide incidence zone.

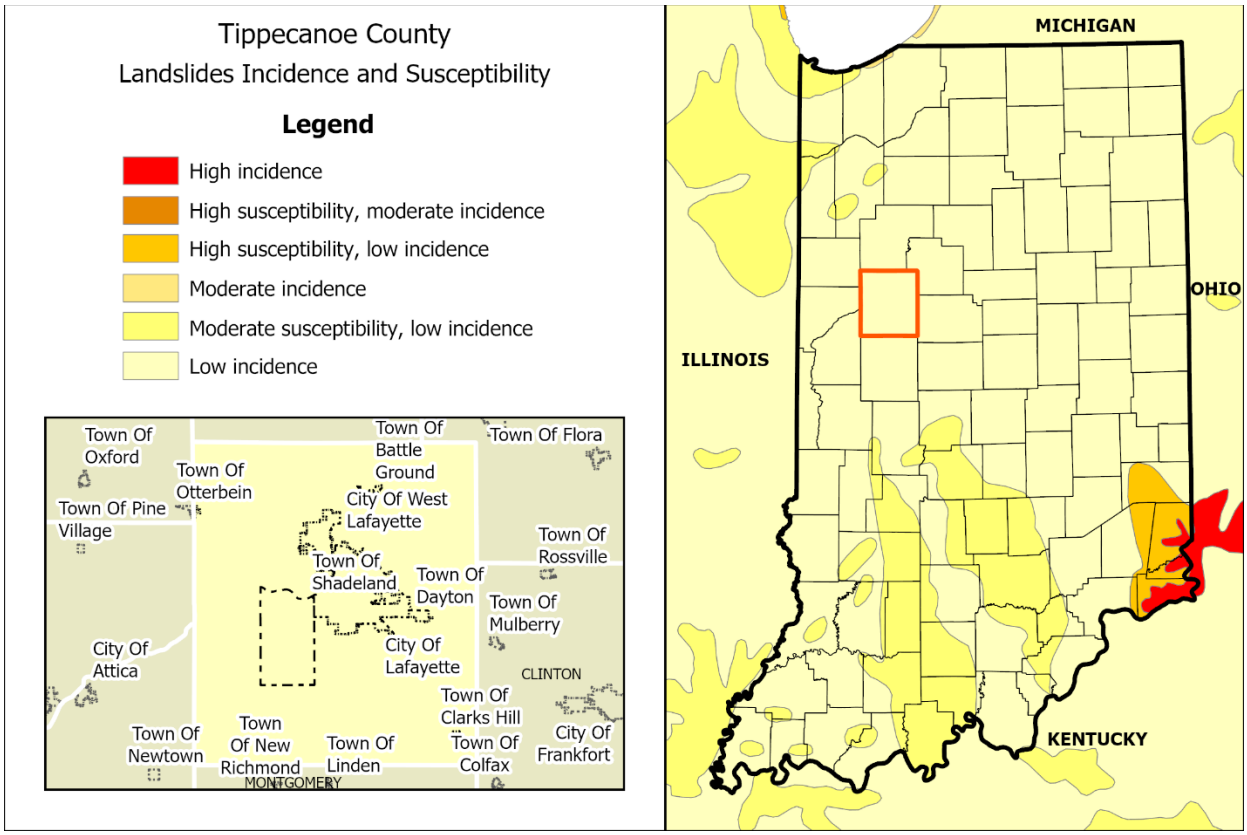

Exhibit 46. USGS Landslide Overview Map

3.3.3.6 Community Development and Future Vulnerability

All future communities, buildings, and infrastructure will remain vulnerable to ground failure in the areas of Tippecanoe County where underground mine features exist, where the structures are located near streams and rivers, and in areas of significant elevation change. In areas with higher levels of population, the vulnerability is greater than in open areas with no infrastructure demands. Abandoned underground mine subsidence may affect several locations within the county; therefore, buildings and infrastructure are vulnerable to subsidence. Continued development will likely occur in many of these areas. Currently, Tippecanoe County reviews new developments for compliance with the local zoning ordinance. Newly planned construction should be reviewed with the historical mining maps to minimize potential subsidence structural damage.

3.3.3.7 Relationship to other Hazards

Flooding – Flooding is typically the leading cause of ground failure, particularly along streams. Ground failure and flooding combine to impact property and infrastructure such as roads and bridges.

3.3.4 Summer Storms and Tornadoes

3.3.4.1 Hazard Definition for Summer Storm

Thunderstorms

Severe thunderstorms are defined as thunderstorms with one or more of the following characteristics: strong winds, large damaging hail, or frequent lightning. Severe thunderstorms most frequently occur in Indiana during the spring and summer but can occur any month of the year at any time of day. A severe thunderstorm's impacts can be localized or widespread in nature. The National Oceanic and Atmospheric Administration's National Weather Service classifies a thunderstorm as severe when it meets one or more of the following criteria:

- Hail with a one-inch diameter or higher
- Wind speeds equal to or greater than 58 miles an hour
- Thunderstorms that produce a tornado

The National Weather Service does not consider lightning frequency a criterion for issuing a severe thunderstorm warning; however, frequent and dangerous lightning is considered a severe weather hazard. The NOAA consistently ranks lightning as one of the top weather killers in the United States.

Lightning

Lightning is caused by the discharge of electricity between clouds or between clouds and the surface of the earth. In a thunderstorm there is a rapid gathering of particles of moisture into clouds and forming of large drops of rain. This gathers electric potential until the surface of the cloud (or the enlarged water particles) is insufficient to carry the charge, and a discharge takes place, producing a brilliant flash of light. The power of the electrical charge and intense heat associated with lightning can electrocute on contact, split trees, ignite fires, and cause electrical failures. Most lightning casualties occur in the summer months, during the afternoon and early evening.

Hail

Hail is a product of a severe thunderstorm. Hail consists of layered ice particles which are developed when strong updrafts within the storm carry water droplets above the freezing level. They remain suspended and continue to grow larger, until their weight can no longer be supported by the winds. The NWS uses the following descriptions when estimating hail sizes: pea size is ¼ inch, marble size is ½ inch, dime size is ¾ inch, quarter size is 1 inch, golf ball size is 1 ¾ inches, and baseball size is 2 ¾ inches. Individuals who serve as volunteer "storm spotters" for the NWS are located throughout the state and are instructed to report hail dime size (¾ inch) or greater. Hailstorms can occur throughout the year; however, the months of maximum hailstorm frequency are typically between May and August. Although hailstorms rarely cause injury or loss of life, they can cause significant damage to property, particularly roofs and vehicles.

Windstorms

Windstorms can and do occur in all months of the year; however, the most severe windstorms usually occur during severe thunderstorms in the warm months. Associated with strong thunderstorms, downbursts are severe localized downdrafts from a thunderstorm or rain shower. This outflow of cool or colder air can create damaging winds at or near the surface. Downburst winds can potentially cause as much damage as a small tornado and are often confused with tornadoes due to the extensive damage that they inflict. As these downburst winds spread out, they are frequently referred to as straight-line winds. Straight-line winds can cause major structural and tree damage over a relatively large area.

Summer storms, including thunderstorms, hailstorms, and windstorms affect Tippecanoe County on an annual basis. Thunderstorms are the most common summer hazardous event in the county, occurring primarily during the months of May through August, with the severest storms most likely to occur from mid-May through mid-July. Typically, thunderstorms are locally produced by cumulonimbus clouds, are always attended by lightning, and are often accompanied by strong wind gusts, heavy rain, and sometimes hail and tornadoes.

3.3.4.2 Hazard Definition for Tornado

The Glossary of Meteorology defines a tornado as a violently rotating column of air with wind speeds between 40-300 mph, in contact with the ground, either pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud. They develop under three scenarios: (1) along a squall line; (2) in connection with thunderstorm squall lines during hot, humid weather; and (3) in the outer portion of a tropical cyclone. Funnel clouds are rotating columns of air not in contact with the ground; however, the column of air can reach the ground very quickly and become a tornado.

Since 2007, tornado strength in the United States is ranked based on the Enhanced Fujita scale (EF scale), replacing the Fujita scale introduced in 1971. The EF scale uses similar principles to the Fujita scale, with six categories from 0-5, based on wind estimates and damage caused by the tornado. The EF Scale is used extensively by the NWS in investigating tornadoes (all tornadoes are now assigned an EF Scale number), and by engineers in correlating damage to buildings and techniques with different wind speeds caused by tornadoes.

Tornado damage curves for the Fujita Scale are shown in the following table, Exhibit 47. The approximate width of the damage and minimum percent damage provide a better understanding of the capabilities of the tornado funnels as the sizes increase.

Enhanced Fujita Scale	Path Width (feet)	Maximum Expected Damage
EF5	3,000	100%
EF4	2,400	100%
EF3	1,800	80%
EF2	1,200	50%
EF1	600	10%
EF0	300	0%

Exhibit 47. Tornado Path Widths and Damage

3.3.4.3 Summer Storm and Tornado History in Tippecanoe County

Summer Storm

The history of summer storms in Tippecanoe County was determined by analyzing the hail, high wind, lightning, strong wind, and thunderstorm wind events for the county in the NCEI database. From 1966 through 2016, there were 348 summer storm-related reports. From 2017 through 2020, there were 69 summer storm-related reports, not including reports of tornados. None of these events had any reported injuries or deaths but resulted in property damage costs. In July 2020, a

thunderstorm wind event blew off large metal doors from the Toyota Tsusho America plant on Haggerty Lane. Thankfully, the tornado warning kept employees safely inside the plant. In May 2019, another thunderstorm wind event tore a roof off of the Wabash National Corporations and overturned trailers. In August 2020, a thunderstorm wind event downed numerous trees and limbs around Battle Ground. This same thunderstorm caused power outages in Battle Ground and Delphi. Additional NCEI events and details about their associated impacts can be found in Appendix A. Exhibit 48 displays the locations for historic hail and wind events in the county.

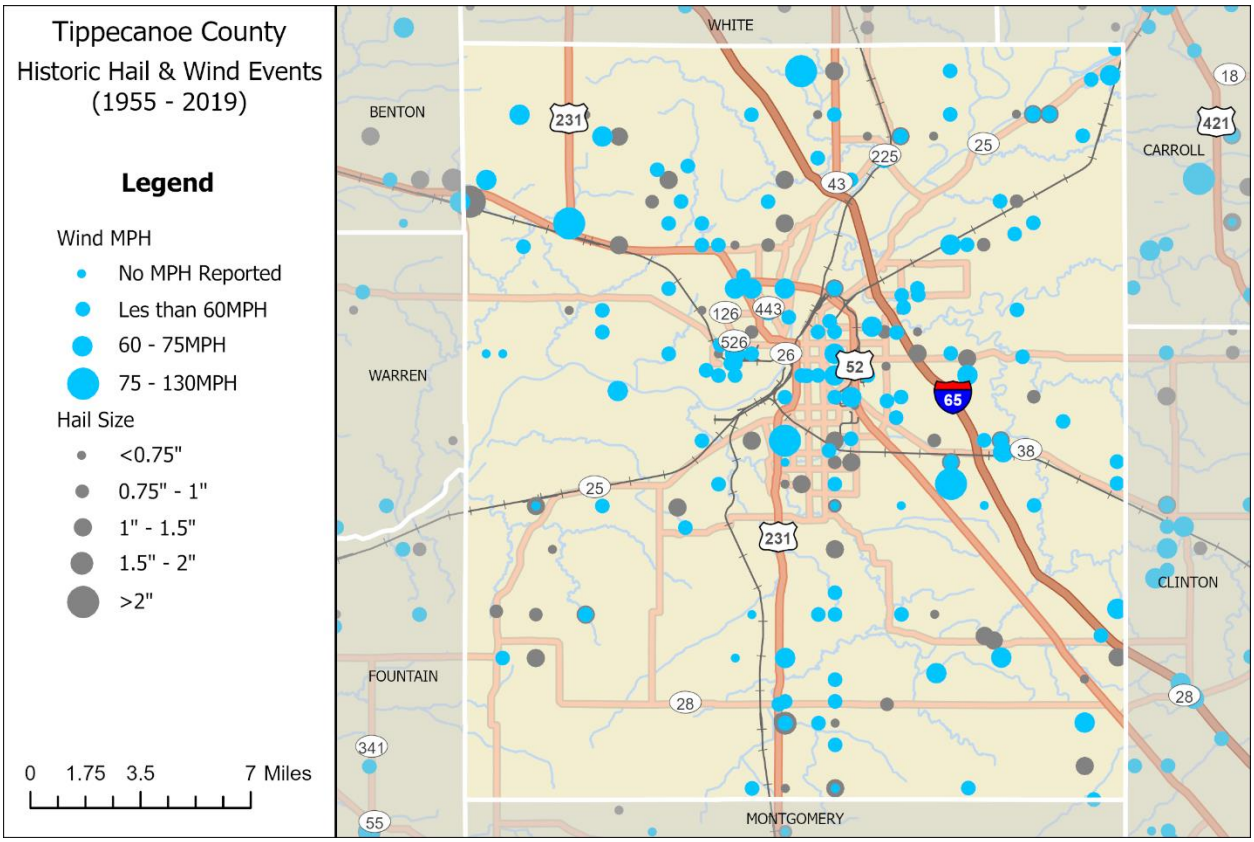

Exhibit 48. Tippecanoe County Historic Hail and Wind Events

Tornado

According to the NCEI there have been 50 occurrences of tornadoes in the county from 1953 through 2016. From 2017 through 2020, there were two tornadoes, both EF0, in Tippecanoe County. Neither tornado touchdown led to injury or death. In November 2017, a tornado briefly touched down northeast of Dayton. A house suffered minor damage and a few trees were downed. This tornado caused an estimated $8,000 in damage. In April 2018, another tornado damaged a homestead, leading to an estimated $25,000 in damage.

Three F4 tornadoes have been recorded in Tippecanoe County since 1953, in April 1965, March 1976, and April 1994. An F3 tornado was recorded in June 1978. These four tornadoes led to 3 deaths, 86 injuries, and $7.5 million in property damages.

Tippecanoe County NCEI recorded tornadoes are identified in Exhibit 49. Exhibit 50 displays historical tornadoes for Tippecanoe County.

Location or County	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Tippecanoe	06/13/1953	F1	0	0	.25K	0K
Tippecanoe	04/3/1956	F2	0	0	25K	0K
Tippecanoe	03/6/1961	F1	0	0	.25K	0K
Tippecanoe	04/22/1963	F2	0	0	2.5K	0K
Tippecanoe	06/10/1963	F1	0	0	2.5K	0K
Tippecanoe	04/11/1965	F4	0	10	0K	0K
Tippecanoe	09/14/1965	F2	0	0	250K	0K
Tippecanoe	06/24/1967	F2	0	0	2.5K	0K
Tippecanoe	05/15/1968	F2	0	0	2.5K	0K
Tippecanoe	03/19/1971	F2	0	0	25K	0K
Tippecanoe	05/29/1973	F0	0	0	.03K	0K
Tippecanoe	06/12/1973	F1	0	0	25K	0K
Tippecanoe	06/12/1973	F1	0	0	.03K	0K
Tippecanoe	04/1/1974	F2	0	0	25K	0K
Tippecanoe	03/12/1976	F1	0	0	0K	0K
Tippecanoe	03/20/1976	F4	0	6	2.5M	0K
Tippecanoe	04/10/1978	F2	0	0	25K	0K
Tippecanoe	04/23/1978	F1	0	0	250K	0K
Tippecanoe	06/25/1978	F0	0	0	0K	0K
Lafayette	04/26/1994	F4	3	70	5M	0K
Tippecanoe	07/2/1978	F1	0	0	25K	0K
Tippecanoe	06/7/1980	F2	0	0	0K	0K
Tippecanoe	06/24/1981	F1	0	0	250K	0K
Tippecanoe	03/27/1991	F0	0	0	0K	0K
Tippecanoe	06/25/1978	F3	0	0	0K	0K
Lafayette	01/18/1996	F0	0	0	0K	0K
West Lafayette	07/4/1998	F1	0	0	200K	0K
Battle Ground	09/28/1999	F1	0	1	300K	0K
West Lafayette	06/11/2003	F0	0	0	0K	0K
Lafayette	06/11/2003	F0	0	0	0K	0K
Lafayette	07/21/2003	F0	0	0	0K	0K
Dayton	05/30/2004	F2	0	0	1M	0K
Romney	05/30/2004	F0	0	0	0K	0K
Dayton	07/26/2005	F0	0	0	10K	0K
Romney	04/2/2006	F1	0	0	50K	0K

Location or County	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Americus	04/14/2006	F1	0	0	30K	0K
Cairo	04/14/2006	F0	0	0	0K	0K
Odell	06/25/2006	F0	0	0	3K	0K
Taylors	04/19/2011	EF1	0	0	80.00K	0K
Buck Creek	04/19/2011	EF0	0	0	15.00K	0K
Montmorencie	11/17/2013	EF1	0	0	18.00K	0K
Concord	11/17/2013	EF1	0	0	10.00K	0K
South Raub	11/17/2013	EF2	0	0	125.00K	0K
South Raub	11/17/2013	EF0	0	0	21.00K	0K
North Crane	11/17/2013	EF3	0	0	750.00K	0K
Odell	11/17/2013	EF2	0	0	10.00K	0K
Stockwell	07/17/2015	EF1	0	0	35.00K	0K
Monroe	07/17/2015	EF1	0	0	30.00K	0K
Meadowbrook	03/31/2016	EF1	0	0	50.00K	0K
Cairo	08/15/2016	EF0	0	0	3.50K	2.00K
Dayton	11/18/2017	EF0	0	0	8.00K	0.00K
Lafayette	04/3/2018	EF0	0	0	25.00K	0.00K

Exhibit 49. Tippecanoe County Tornadoes*

* NCEI records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

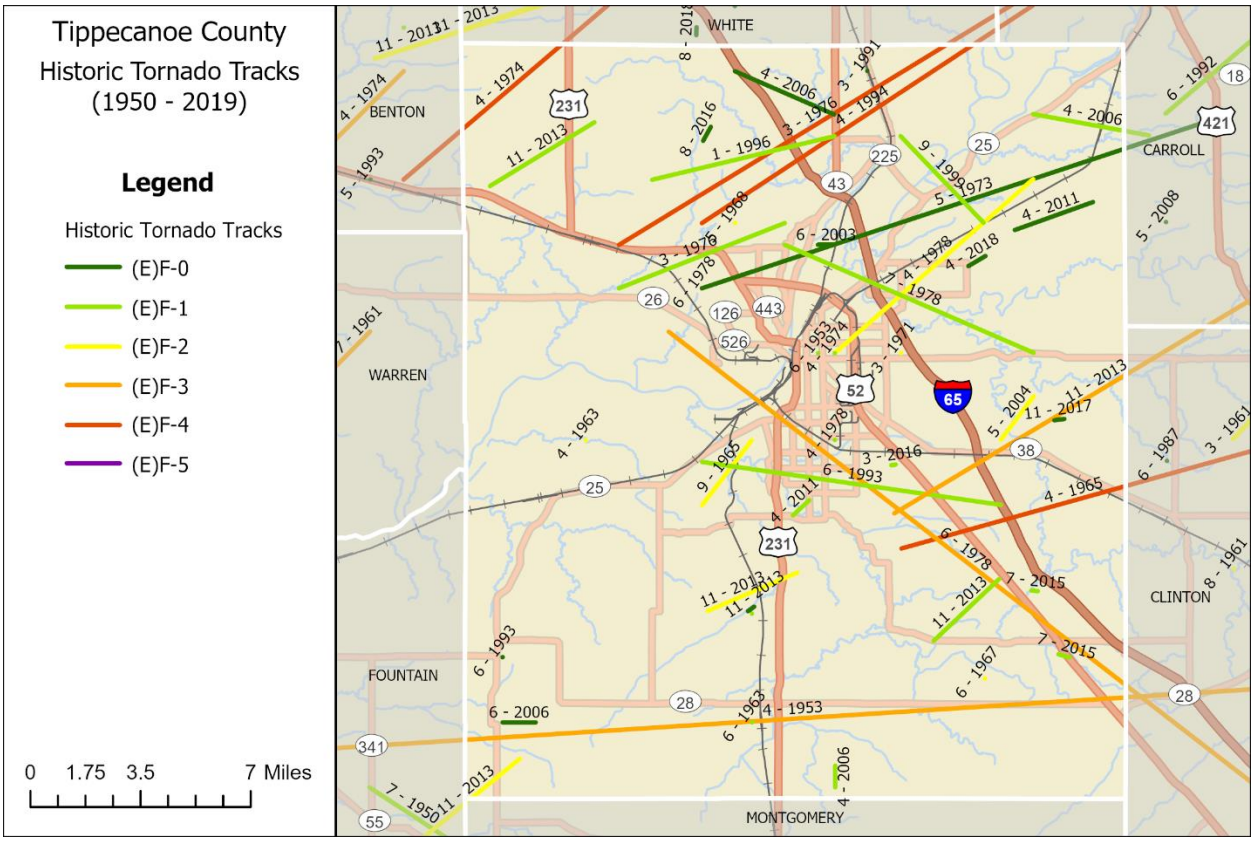

Exhibit 50. Historical Tornado Tracks and Touchdowns for Tippecanoe County

3.3.4.4 Geographic Location for Summer Storm and Tornado

The entire county has the same risk for occurrence of summer storms and tornadoes. They can occur at any location within the county.

3.3.4.5 Hazard Extent for Summer Storm and Tornado

The extent of the summer storm and tornado hazards vary both in terms of the extent of the path of the event and the wind speed.

3.3.4.6 Vulnerability Analysis for Summer Storm and Tornado

During a tornado the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a tornado. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g. loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

All facilities are vulnerable to severe thunderstorms. These facilities will encounter many of the same impacts as any other building within the jurisdiction including structural failure, damaging debris (trees or limbs), roofs blown off or windows broken by hail or high winds, fires caused by

lightning, and loss of building functionality; a damaged police station, for example, would no longer be able to serve the community. Additionally, bridges could fail or become impassable, causing risks to traffic.

During a severe thunderstorm, the types of infrastructure that could be impacted include roadways, utility lines and pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these structures could become damaged during a severe thunderstorm. The impacts to these structures include impassable roadways, broken or failed utility lines, causing loss of power or gas to the community, or railway failure from broken or impassable tracks.

GIS Tornado Analysis

The following analysis completed for the plan update utilizes an example scenario to gauge the anticipated impacts of tornadoes in the county in terms of numbers and types of buildings and infrastructure.

GIS overlay modeling was used to determine the potential impacts of an EF-4 tornado. The analysis used a hypothetical tornado path that runs for 16 miles through the northern half of the county. This scenario includes impacts to the major employers of the county. The selected widths were modeled after a recreation of the Fujita-Scale guidelines based on conceptual wind speeds, path widths, and path lengths. There is no guarantee that every tornado will fit exactly into one of these six categories. Exhibit 50 depicts tornado damage curves as well as path widths.

Fujita Scale	Path Width (feet)	Maximum Expected Damage
EF-5	3000	100%
EF-4	2400	100%
EF-3	1800	80%
EF-2	1200	50%
EF-1	600	10%
EF-0	300	0%

Exhibit 50. Tornado Path Widths and Damage Curves

Within any given tornado path there are degrees of damage. The most intense damage occurs within the center of the damage path with a decreasing amount of damage away from the center of the path. This natural process was modeled in GIS by adding damage zones around the tornado path. Exhibit 51 and 52 give additional information on tornado damage zones.

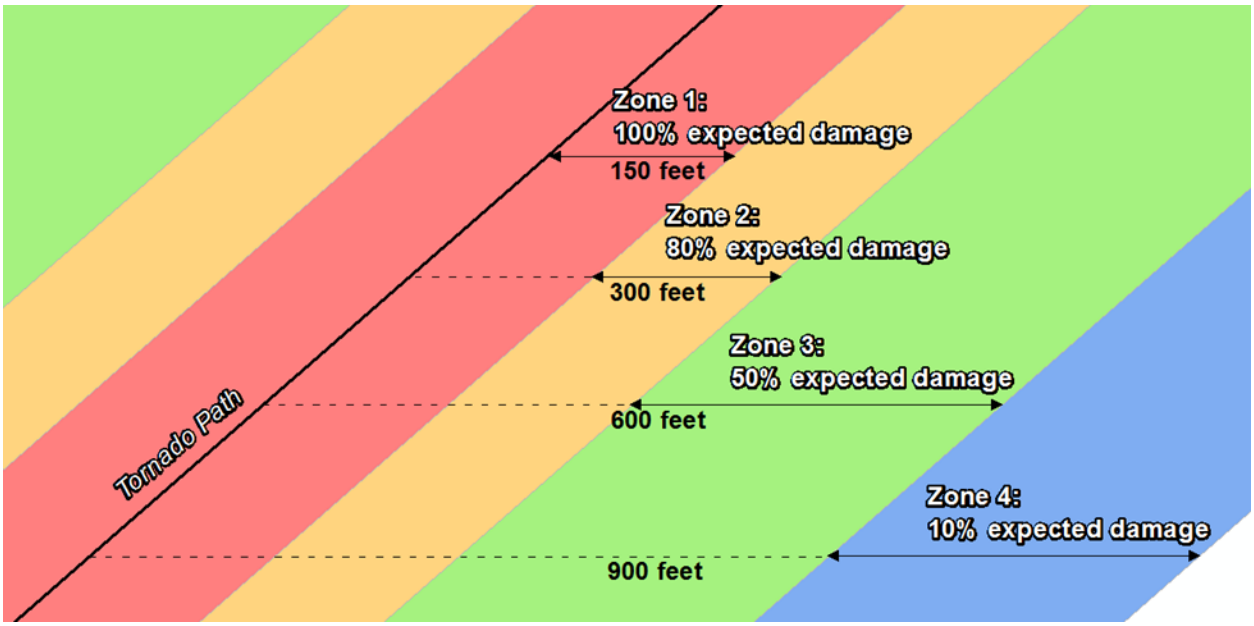

Exhibit 51. EF-4 Tornado Analysis, Using GIS Buffers

Fujita Scale	Zone	Buffer (feet)	Damage Curve
EF-4	4	900-1200	10%
EF-4	3	600-900	50%
EF-4	2	300-600	80%
EF-4	1	0-300	100%

Exhibit 52. EF-4 Tornado Zones and Damage Curves

The results of the analysis are depicted in Exhibit 54 and 55. The GIS analysis estimates that 1,575 buildings would be damaged. The estimated building losses are $315.5 million. The building losses are an estimate of building replacement costs multiplied by the percentages of damage. The overlay was performed against the Building Inventory created at an earlier stage using the Assessor data in combination with Parcel records. NOTE: The assessor records often do not include nontaxable parcels and associated building improvements therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated. Exhibits 53 through 55 show the random path chosen for this study.

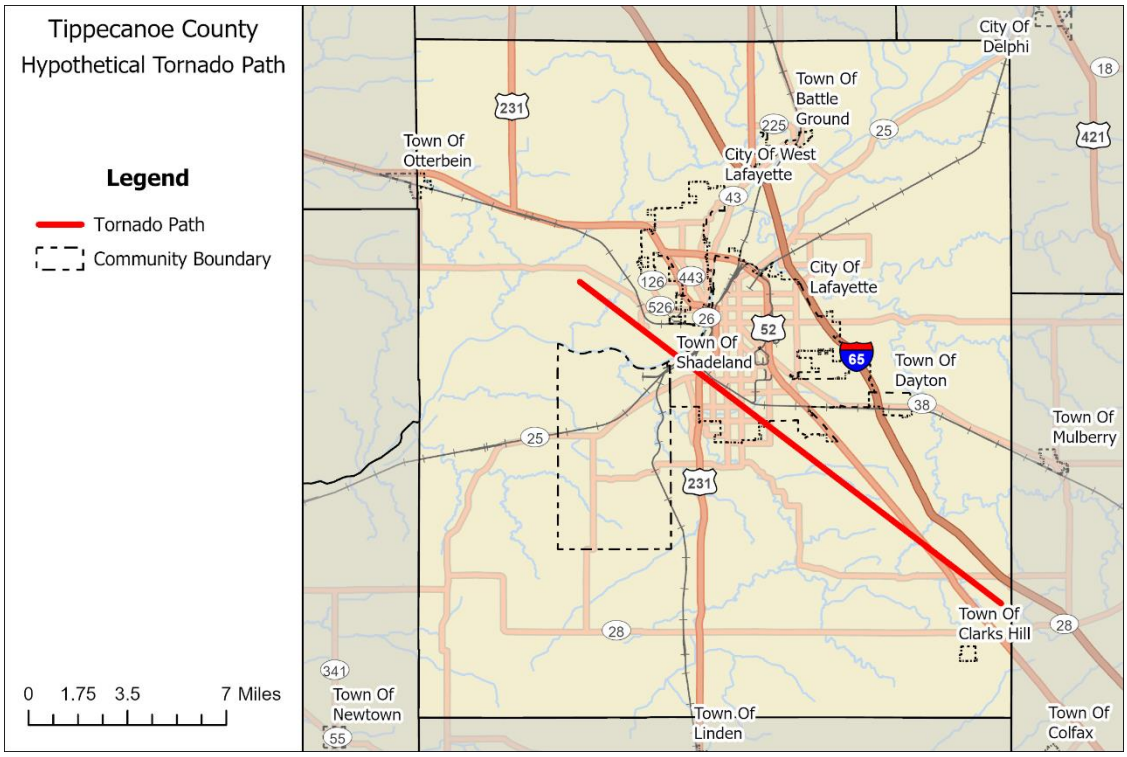

Exhibit 53. Modeled F4 Tornado Damage Hypothetical Path

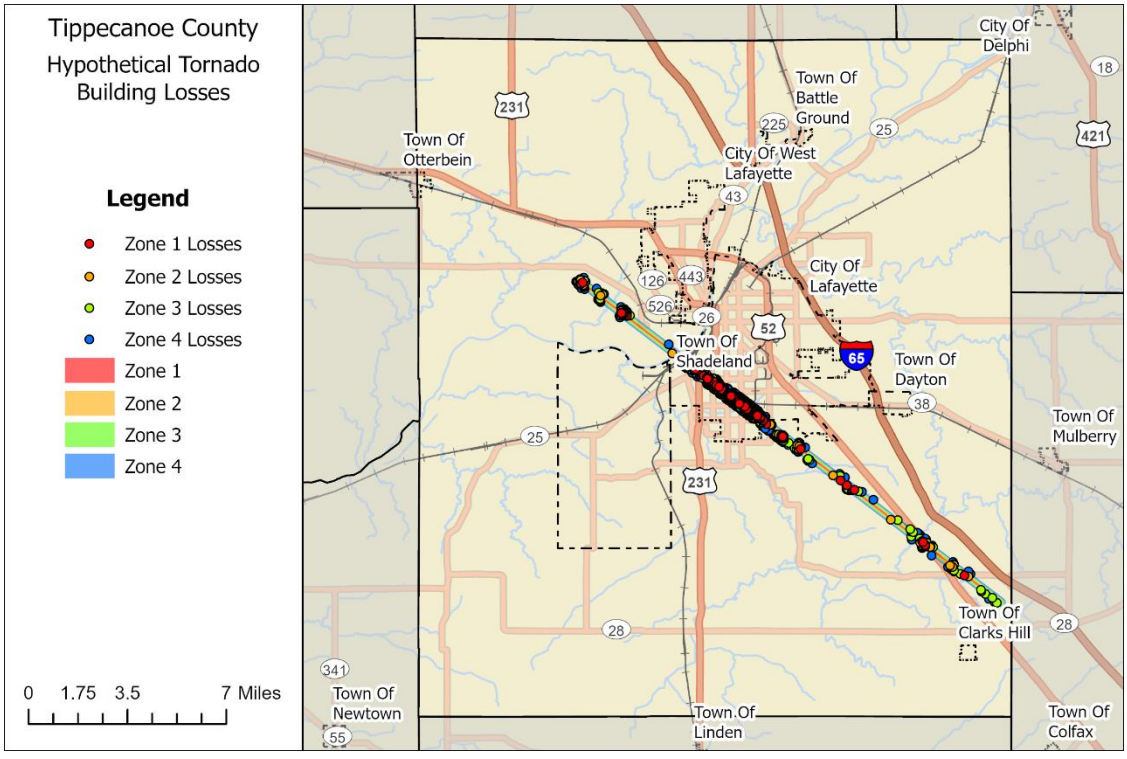

Exhibit 54. Tornado Path with Damaged Buildings

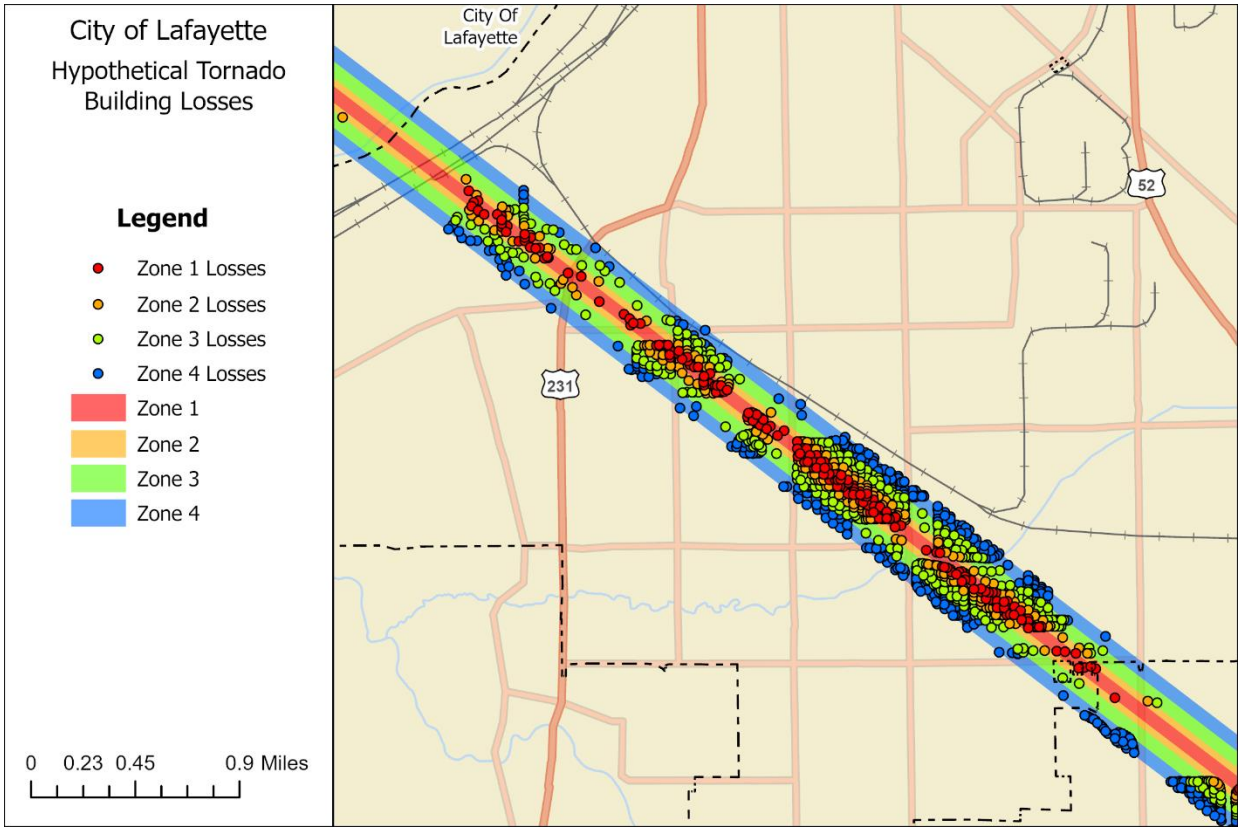

Exhibit 55. Tornado Path: Lafayette

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	230	232	472	464
Commercial	13	9	15	24
Industrial	-	2	-	-
Agriculture	3	3	8	9
Religious	3	3	4	2
Government	-	-	-	-
Education	1	1	3	-
Total	**250**	**250**	**502**	**499**

Exhibit 56. Estimated Building Losses by Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	$44,477,222	$35,389,497	$45,553,703	$9,107,662
Commercial	$5,919,884	$2,952,389	$2,797,055	$745,342
Industrial	-	$1,755,277	-	-
Agriculture	$689,283	$357,706	$752,694	$161,775
Religious	$1,533,442	$1,808,106	$1,649,661	$126,356

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Government	-	-	-	-
Education	$272,365	$217,892	$411,162	-
Total	**$52,892,196**	**$42,480,869**	**$51,164,275**	**$10,141,134**

Exhibit 57. Estimated Losses by Zone

Facility and Infrastructure Damage

Five essential facilities are in the hypothetical tornado's path: two schools and three care facilities. These are shown in Exhibit 58 and listed Exhibit 59. Eleven critical facilities are in the tornado's path: 8 bridges, 2 hazardous materials facilities, and one airport. The affected airport and hazardous materials facilities are shown in Exhibit 60 and listed in Exhibit 61.

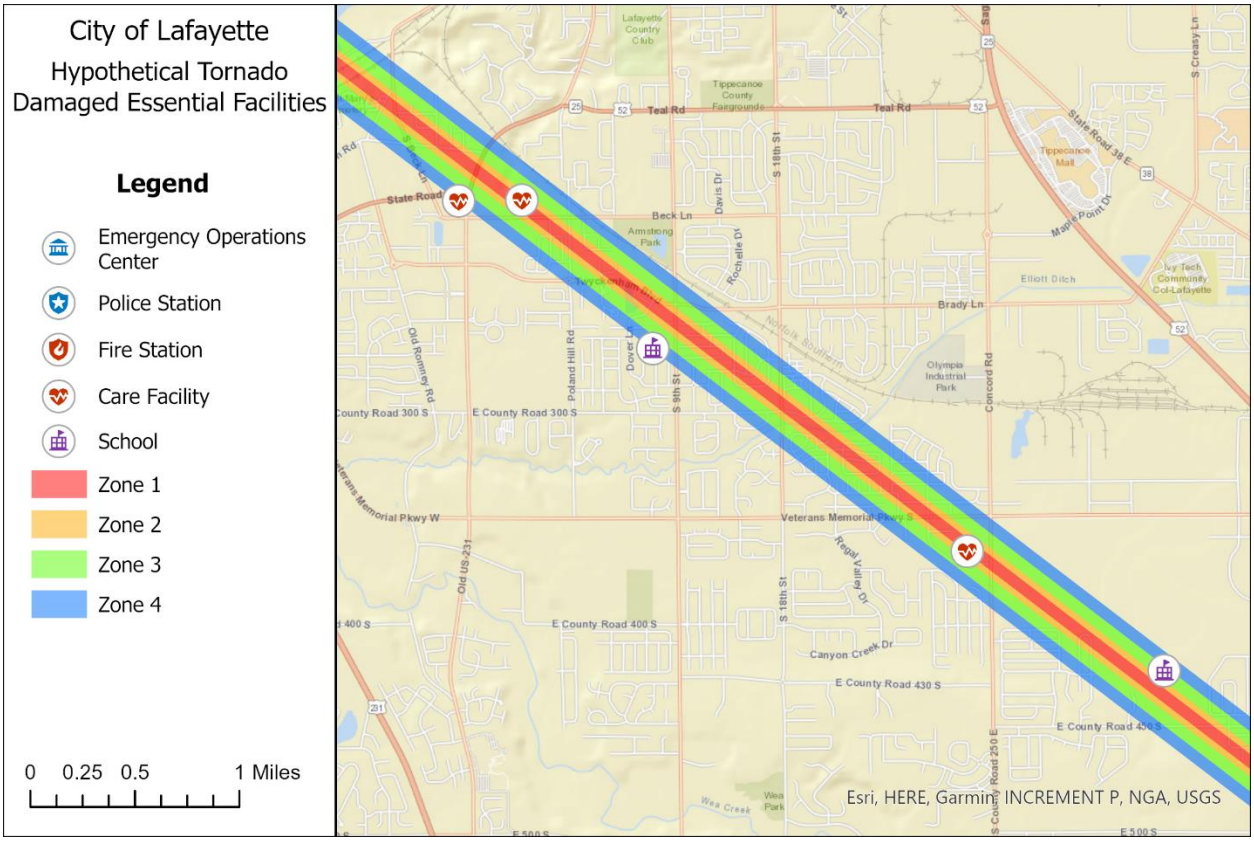

Exhibit 58. Hypothetical Damages to Essential Facilities, Lafayette

Facility Type	Name	Address	City
School	Woodland Elementary School	3200 E 450 S	Lafayette
School	Amelia Earhart Elem Sch	3280 S 9th St	Lafayette
Care Facility	Wal Mart 3851	2347 E 350 S	Lafayette
Care Facility	Walgreens	2800 Old Us Hwy 231 S	Lafayette
Care Facility	Glasswater Creek of Lafayette	208 Beck Ln	Lafayette

Exhibit 59. Essential Facilities in Hypothetical Tornado Path

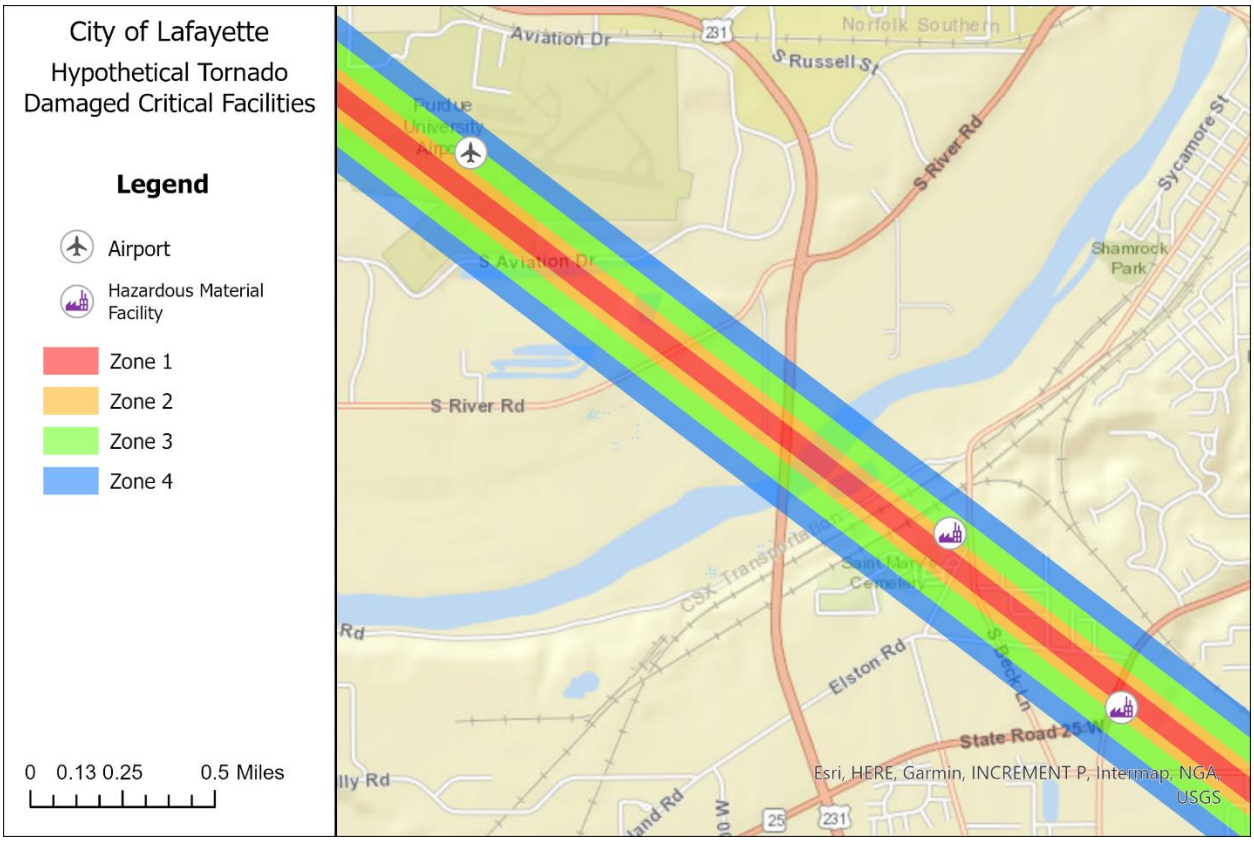

Exhibit 60. Hypothetical Damages to Critical Facilities, Lafayette

Facility Type	Name	Address	City
Airport	Purdue University	Airport	Lafayette
Hazardous Material Facility	Speedway Service Station #1311	2705 Old Us Hwy 231 S	Lafayette
Hazardous Material Facility	Waste Management	2120 Wabash Ave	Lafayette

Exhibit 61. Critical Facilities in Hypothetical Tornado Path

3.3.4.7 Community Development Trends and Future Vulnerability

The entire population and buildings have been identified as at risk because summer storms and tornadoes can occur anywhere within the state of Indiana at any time of the day. Furthermore, any future development in terms of new construction within the county will be at risk. All critical facilities in the county and communities within the county are at risk. Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warnings of approaching storms are also vital to preventing the loss of property and ensuring the safety of Tippecanoe County residents.

3.3.4.8 Relationship to other Hazards

Flooding – Thunderstorms with heavy amounts of rainfall can cause localized flooding, which can impact property and infrastructure such as roads.
Public Health – Public health can be impacted as a result of wastewater spills due to flooding.
Wildland Fire – Lighting strikes may ignite a wildland fire. Windstorms that result in downed timber increase the fuel load in a forest that may increase the risk of wildfire.
Structural Fire – Lighting strikes may ignite a structural fire.

3.3.5 Drought

3.3.5.1 Hazard Definition for Drought

The meteorological condition that creates a drought is below normal rainfall. However, excessive heat can lead to increased evaporation, which will enhance drought conditions. Droughts can occur in any month. Drought differs from normal arid conditions found in low rainfall areas. Drought is the consequence of a reduction in the amount of precipitation over an undetermined length of time (usually a growing season or more).

The Palmer Drought Severity Index (PDSI), developed by W.C. Palmer in 1965, is a soil moisture algorithm utilized by most federal and state government agencies to trigger drought relief programs and responses. The objective of the PDSI is to provide standardized measurements of moisture, so that comparisons can be made between locations and periods of time—usually months. The PDSI is designed so that a -4.0 in Indiana has the same meaning in terms of the moisture departure from a climatological normal as a -4.0 does in South Carolina.

The U.S. Drought Monitor (USDM) provides a national assessment on drought conditions in the United States. The following table is a reference from the classification scheme provided by the USDM, and the correlation between PDSI and the category, descriptions, and possible impacts associated with those level events. This classification is often used to refer to the severity of droughts for statistical purposes. The USDM provides weekly data for each county, noting the percent of land cover in the condition of the drought category identified below, (exhibit 62).

Category	Description	Possible Impacts	Palmer Drought Severity Index
D0	Abnormally Dry	Going into drought: -short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits	-1.0 to -1.9
D1	Moderate Drought	-Some damage to crops, pastures -Streams, reservoirs, or wells low, some water shortages developing or imminent -Voluntary water-use restrictions requested	-2.0 to -2.9
D2	Severe Drought	-Crop or pasture losses likely -Water shortages common -Water restrictions imposed	-3.0 to -3.9
D3	Extreme Drought	-Major crop/pasture losses -Widespread water shortages or restrictions	-4.0 to -4.9
D4	Exceptional Drought	-Exceptional and widespread crop/pasture losses -Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less

Exhibit 62. USDM Index

In the past decade, the US has continued to consistently experience drought events with economic impacts greater than $1 billion; FEMA estimates that the nation's average annual drought loss is $6 billion to $8 billion. For Indiana alone, the National Drought Mitigation Center reported hundreds of droughts impacts in the past decade ranging from water shortage warnings to reduced crop yields and wildfires.

3.3.5.2 Drought History in Tippecanoe County

Since the last MHMP, the National Drought Mitigation Center and the Indiana Drought Monitor have recorded several incidences of drought in Tippecanoe County.

Tippecanoe experienced a drought during the summer of 2012. During this drought, parts of the county were in a D3 drought for 5 weeks from mid-July to mid-August, and the whole county was in a D2 drought from early July to early September.

The county experienced areas of moderate droughts from late October 2015 to early January 2016, from late August 2019 to late September 2019, and from October 2020 to early November 2020.

3.3.5.3 Geographic Location for Drought

Droughts are regional in nature. All areas of the county are vulnerable to the risk of drought.

3.3.5.4 Hazard Extent for Drought

Droughts can be widespread or localized events. The extent of the drought varies both in terms of the extent of the heat and the range of precipitation.

3.3.5.5 Vulnerability Analysis for Drought

Drought impacts, as described in the drought history previously, are a distributed threat across the entire jurisdiction; therefore, the whole county is vulnerable to this hazard and can expect the same impacts within the affected area.

3.3.5.6 Community Development Trends and Future Vulnerability

Drought impacts, as described in the drought history section, are a threat across the entire jurisdiction; therefore, the whole county is vulnerable to this hazard and can expect varying impacts within the affected area. Future development will remain vulnerable to drought events. Typically, some urban and rural areas are more susceptible than others. Excessive demands for water in populated urban areas place a limit on water resources. In rural areas, crops and livestock may suffer from extended periods of drought.

3.3.5.7 Relationship to other Hazards

Wildfires - A drought situation can significantly increase the risk of wildfire.
Extreme Temperatures - A drought situation can significantly increase with long periods of high temperatures.

3.3.6 Winter Storms: Blizzards, Ice Storms, Snowstorms

3.3.6.1 Hazard Definition for Winter Storm

Severe winter weather consists of various forms of precipitation and strong weather conditions. This may include one or more of the following: freezing rain, sleet, heavy snow, blizzards, icy roadways, extreme low temperatures, and strong winds. These conditions can cause human-health risks such as frostbite, hypothermia, and death.

Ice Storms

Ice or sleet, even in the smallest quantities, can result in hazardous driving conditions and can be a significant cause of property damage. Sleet can be easily identified as frozen raindrops. Sleet does not stick to trees and wires. The most damaging winter storms in Indiana have been ice storms. Ice storms are the result of cold rain that freezes on contact with objects having a temperature below freezing. Ice storms occur when moisture-laden gulf air converges with the northern jet stream, causing strong winds and heavy precipitation. This precipitation takes the form of freezing rain, coating power lines, communication lines, and trees with heavy ice. The winds then will cause the overburdened limbs and cables to snap, leaving large sectors of the population without power, heat, or communication. Falling trees and limbs also can cause building damage during an ice storm. In the past few decades, numerous ice-storm events have occurred in Indiana.

Snowstorms

Significant snowstorms are characterized by the rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility. A blizzard is categorized as a snowstorm with winds of 35 miles an hour or greater and/or visibility of less than one-quarter mile for three or more hours. The strong winds during a blizzard blow about falling and already existing snow, creating poor visibility and impassable roadways. Blizzards have the potential to result in property damage.

Indiana has been struck repeatedly by blizzards. Blizzard conditions not only cause power outages and loss of communication, potentially for days, but can also make transportation difficult. The blowing of snow can reduce visibility to less than one-quarter mile, and the resulting disorientation makes even travel by foot dangerous, if not deadly.

Damages from blizzards can range from significant snow removal costs to human and livestock deaths. Because of the blinding potential of heavy snowstorms, drivers are also at risk of collisions with snowplows or other road traffic. Stranded drivers can make uninformed decisions, such as leaving the car to walk in conditions that put them at risk. Drivers and homeowners without emergency plans and kits are vulnerable to the life-threatening effects of heavy snow storms such as power outages, cold weather, and inability to travel, communicate, obtain goods or reach their destinations. Heavy snow loads can cause structural damage, particularly in areas where there are no building codes or for residents living in manufactured home parks.

3.3.6.2 Winter Storm History in Tippecanoe County

The NCEI database identified 10 winter storm, heavy snow, ice storm, winter weather, or blizzard events for Tippecanoe County from 2010 through 2020. These generally consisted of 5 to 9 inches of snowfall, but there were no recorded injuries, deaths, or associated damage costs. Additional details for NCEI events are included in Appendix A.

3.3.6.3 Geographic Location for Winter Storm

Severe winter storms are regional in nature. Most of the NCEI data is calculated regionally or in some cases statewide.

3.3.6.4 Hazard Extent for Winter Storm

The extent of the historical winter storms varies in terms of storm location, temperature, and ice or snowfall. A severe winter storm can occur anywhere in the jurisdiction.

3.3.6.5 Vulnerability Analysis for Winter Storm

Winter storm impacts are equally distributed across the entire jurisdiction; therefore, the entire county is vulnerable to a winter storm and can expect the same impacts within the affected area. The impacts to the general buildings within the county are similar to the damages expected to the critical facilities. These include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow.

During a winter storm, the types of infrastructure that could be impacted include essential and critical facilities, roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable it is important to emphasize that any number of these items could become damaged during a winter storm. Potential impacts include broken gas and/or electricity lines or damaged utility lines, damaged or impassable roads and railways, and broken water pipes.

3.3.6.6 Community Development Trends and Future Vulnerability

Any new development within the county will remain vulnerable to these events. Because the winter storm events are regional in nature, future development will be equally impacted across the county.

3.3.6.7 Relationship to other Hazards

Flooding – Melting from heavy snows can cause localized flooding which can impact property and infrastructure such as roads.

Wildland or Structural Fire – Heavy storms that result in large amounts of downed timber can result in an increase of dead or dying trees left standing, thus providing an increased fuel load for a wildfire. There is an additional risk of increased frequency of structural fires during heavy snow events, primarily due to utility disruptions and the use of alternative heating methods by residents.

Public Safety – Drivers stranded in snowstorms may make uninformed decisions that can put them at risk; residents who are unprepared or vulnerable may not be able to obtain goods or reach their destinations. EMS providers may be slowed by road conditions to respond to emergencies. Ice storms may result in power outages due to downed power lines, putting people at risk for cold temperature exposure and reducing the ability to spread emergency messages to the public via television, radio or computer.

3.3.7 Extreme Temperatures

3.3.7.1 Hazard Definition for Extreme Temperatures

Extreme Cold

What constitutes an extreme cold event and its effects varies by region across the US. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Extreme cold temperatures are typically characterized by the ambient air temperature dropping to approximately zero degrees Fahrenheit or below.

Exposure to cold temperatures—indoors or outdoors—can lead to serious or life-threatening health problems, including hypothermia, cold stress, frostbite or freezing of the exposed extremities, such as fingers, toes, nose, and earlobes. Certain populations—such as seniors age 65 or older, infants and young children under five years of age, individuals who are homeless or stranded, or those who live in a home that is poorly insulated (such as mobile homes) or without heat —are at greater risk to the effects of extreme cold.

The magnitude of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. WCT are the temperatures felt outside and is based on the rate of heat loss from exposed skin by the effects of wind and cold. As the wind increases, the body is cooled at a faster rate causing the skin's temperature to drop.

In 2001, the NWS implemented a new WCT Index, designed to more accurately calculate how cold air feels on human skin. The index, shown in Exhibit 63, includes a frostbite indicator, showing points where temperature, wind speed, and exposure time will produce frostbite in humans.

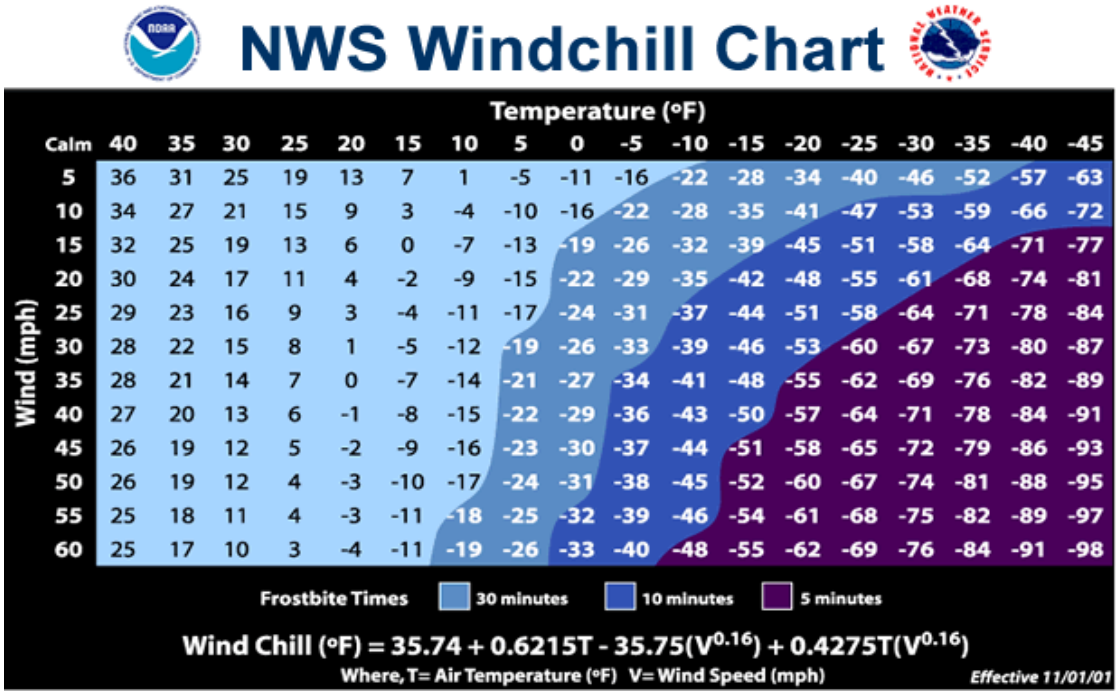

Exhibit 63. NWS Wind Chill Temperature Index

Extreme Heat

Human beings need to maintain a constant body temperature if they are to stay healthy. Working in high temperatures induces heat stress when more heat is absorbed into the body than can be dissipated out. Heat illness such as prickly heat, fainting from heat exhaustion, or heat cramps are visible signs that people are working in unbearable heat. In the most severe cases, the body temperature control system breaks down altogether and body temperature rises rapidly. This is a heat stroke, which can be fatal. The NWS issues a heat advisory when, during a 24-hour period, the temperature ranges from 105°F to 114°F during the day, and remains at or above 80°F at night. Heat is the leading weather-related killer in the United States, even though most heat-related deaths are preventable through outreach and intervention. According to the National Oceanic and Atmospheric Administration, the summer of 2016 was one of the five hottest on record dating to the late 19th century.

Unusually hot summer temperatures have become more frequent across the contiguous 48 states in recent decades (see the High and Low Temperatures indicator), and extreme heat events (heat waves) are expected to become longer, more frequent, and more intense in the future. As a result, the risk of heat-related deaths and illness is also expected to increase. Temperatures that hover 10 degrees Fahrenheit or more above the average high temperature for a region, and last for several weeks, constitute an extreme heat event (EHE). An extended period of extreme heat of three or more consecutive days is typically referred to as a heat wave. Most summers see EHEs in one or more parts east of the Rocky Mountains. They tend to combine both high temperatures and high humidity; although some of the worst heat waves have been catastrophically dry.

Heat alert procedures are based primarily on Heat Index Values. The Heat Index—given in degrees Fahrenheit—is often referred to as the apparent temperature and is a measure of how hot it really

feels when the relative humidity is factored with the actual air temperature. The National Weather Service Heat Index Chart can be seen in Exhibit 64.

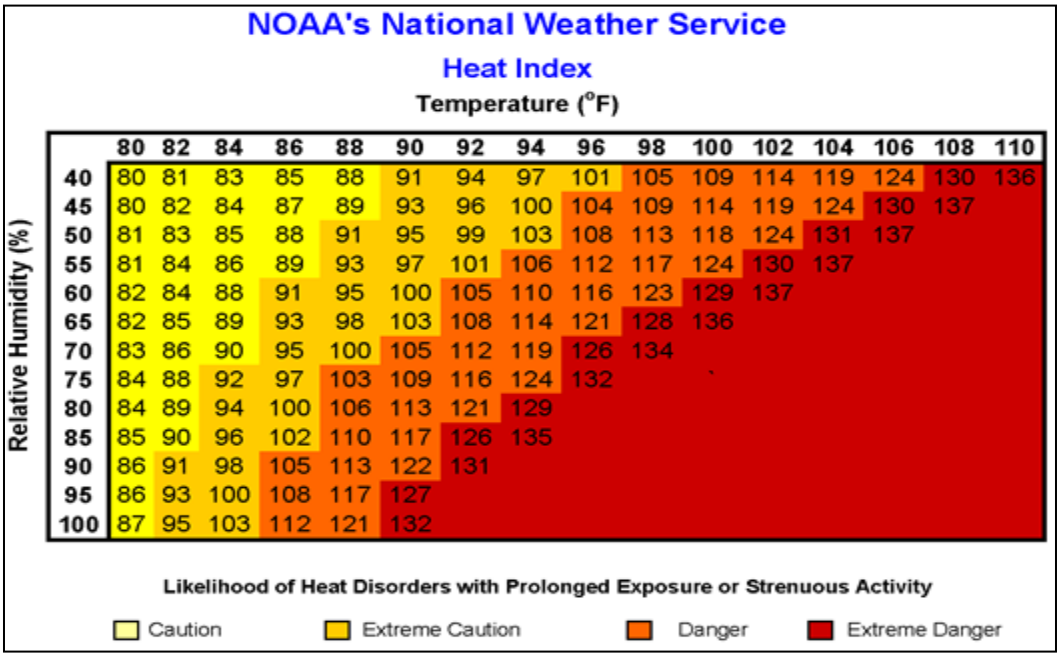

Exhibit 64. National Weather Service Heat Index

Source: Office of Atmospheric Programs. (2006). Excessive Heat Events Guidebook. Unites States Environmental Protection Agency. Washington, D.C.

3.3.7.2 Extreme Temperature History in Tippecanoe County

There are no reported occurrences of extreme cold or excessive heat in the NCEI database.

3.3.7.3 Geographic Location for Extreme Temperature

Extreme temperatures are regional in nature. All areas of the Tippecanoe County are vulnerable to the risk of extreme cold or extreme heat.

3.3.7.4 Hazard Extent for Extreme Temperature

Extreme temperatures are normally widespread events.

3.3.7.5 Vulnerability Analysis for Extreme Temperature

Extreme temperature impacts are an equally distributed threat across the entire jurisdiction; therefore, the county is vulnerable to this hazard and can expect the same impacts within the affected area. According to FEMA, approximately 175 Americans die each year from extreme heat.

Prolonged exposure to extreme heat may lead to serious health problems, including heat stroke, heat exhaustion, or sunburn. Certain populations — such as seniors age 65 and over, infants and young children under five years of age, pregnant women, the homeless or poor, the obese, and people with mental illnesses, disabilities, and chronic diseases — are at greater risk to the effects

of extreme heat and extreme cold. Depending on severity, duration, and location these populations may not have ready access to cooling or warming centers.

3.3.7.6 Community Development Trends and Future Vulnerability

Because extreme temperatures are regional in nature, future development will be impacted across the county. Although urban and rural areas are equally vulnerable to this hazard, those living in urban areas may have a greater risk from the effects of a prolonged heat wave. The atmospheric conditions that create extreme heat tend to trap pollutants in urban areas, adding contaminated air to the excessively hot temperatures and creating increased health problems. Furthermore, asphalt and concrete store heat longer, gradually releasing it at night and producing high nighttime temperatures. This phenomenon is known as the "urban heat island effect." Local officials should address extreme temperature hazards by educating the public on steps to take before and during the event and locations of cooling and warming centers.

3.3.7.7 Relationship to other Hazards

Drought and Wildfire - Dry, hot conditions can reduce the protective moisture of woodlands and increase the risk of wildfire.
Public Safety - Anyone exposed to extreme heat can develop heat exhaustion and heat stroke. The elderly, children and those who engage in outdoor work or recreation may be most susceptible to the danger of extreme heat.

3.3.8 Hazardous Material Release

3.3.8.1 Hazard Description for Hazardous Material Release

The State of Indiana has numerous active transportation lines that run through many of its counties. Active railways transport harmful and volatile substances between our borders every day. The transportation of chemicals and substances along interstate routes is commonplace in Indiana. The rural areas of Indiana have considerable agricultural commerce, creating a demand for fertilizers, herbicides, and pesticides to be transported along rural roads. Finally, Indiana is bordered by two major rivers and Lake Michigan. Barges transport chemicals and substances along these waterways daily. These factors increase the chance of hazardous material releases and spills throughout the State of Indiana.

The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials and chemicals, dust, and bombs. An explosion potentially can cause death, injury, and property damage. In addition, a fire routinely follows an explosion, which may cause further damage and inhibit emergency response. Emergency response may require fire, safety and law enforcement, search and rescue, and hazardous materials units.

3.3.8.2 Hazardous Incident History in Tippecanoe County

Tippecanoe County has not experienced a significantly large-scale hazardous material incident at a fixed site or during transport resulting in multiple deaths or serious injuries, although there have

been many minor releases that have put local firefighters, hazardous materials teams, emergency management, and local law enforcement into action to try to stabilize these incidents and prevent or lessen harm to Tippecanoe County residents.

3.3.8.3 Geographic Location for Hazardous Material Release

The hazardous material hazards are countywide and are primarily associated with the transport of materials via highway, railroad, and/or river barge.

3.3.8.4 Hazard Extent for Hazardous Material Release

The extent of the hazardous material (referred to as hazmat) hazard varies in terms of the quantity of material being transported as well as the specific content of the container. Hazardous material impacts are an equally distributed threat across the entire jurisdiction; therefore the entire county is vulnerable to a hazardous material release and can expect the same impacts within the affected area. The main concern during a release or spill is the population affected. This plan will therefore consider all buildings located within the county as vulnerable.

3.3.8.5 Vulnerability Analysis for Hazardous Materials Release

The hazardous material release hazards are countywide and primarily are associated with the transport of materials by highway and/or railroad. During a hazardous material release, the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads and bridges. The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials/chemicals, dust, and bombs. An explosion potentially can cause death, injury, and property damage. In addition, a fire routinely follows an explosion, which may cause further damage and inhibit emergency response.

3.3.8.6 GIS Hazmat Analysis

The U.S. EPA's ALOHA (Area Locations of Hazardous Atmospheres) model was utilized to assess the area of impact for an anhydrous ammonia release at the Norfolk Southern railroad tracks at Lafontaine Street located centrally in the City of Template.

ALOHA generates a threat zone area where a hazard (such as toxicity or thermal radiation) has exceeded a user-specified Level of Concern (LOC). ALOHA will display up to three threat zones overlaid on a single picture. The US EPA developed Acute Exposure Guideline Levels (AEGLs), which are exposure guidelines designed to help responders deal with emergencies involving chemical spills or other catastrophic events where members of the general public are exposed to a hazardous airborne chemical.
AEGLs are intended to describe the health effects on humans due to once-in-a-lifetime or rare exposure to airborne chemicals. The National Advisory Committee for AEGLs is developing these guidelines to help both national and local authorities, as well as private companies, deal with emergencies involving spills or other catastrophic exposures.

- **Zone 1 (AEGL 1):** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience notable

discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure

- **Zone 2 (AEGL 2):** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape
- **Zone 3 (AEGL 3):** Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million (ppm). Exhibit 65 is an illustration of the toxic threat plume footprint as determined by ALOHA.

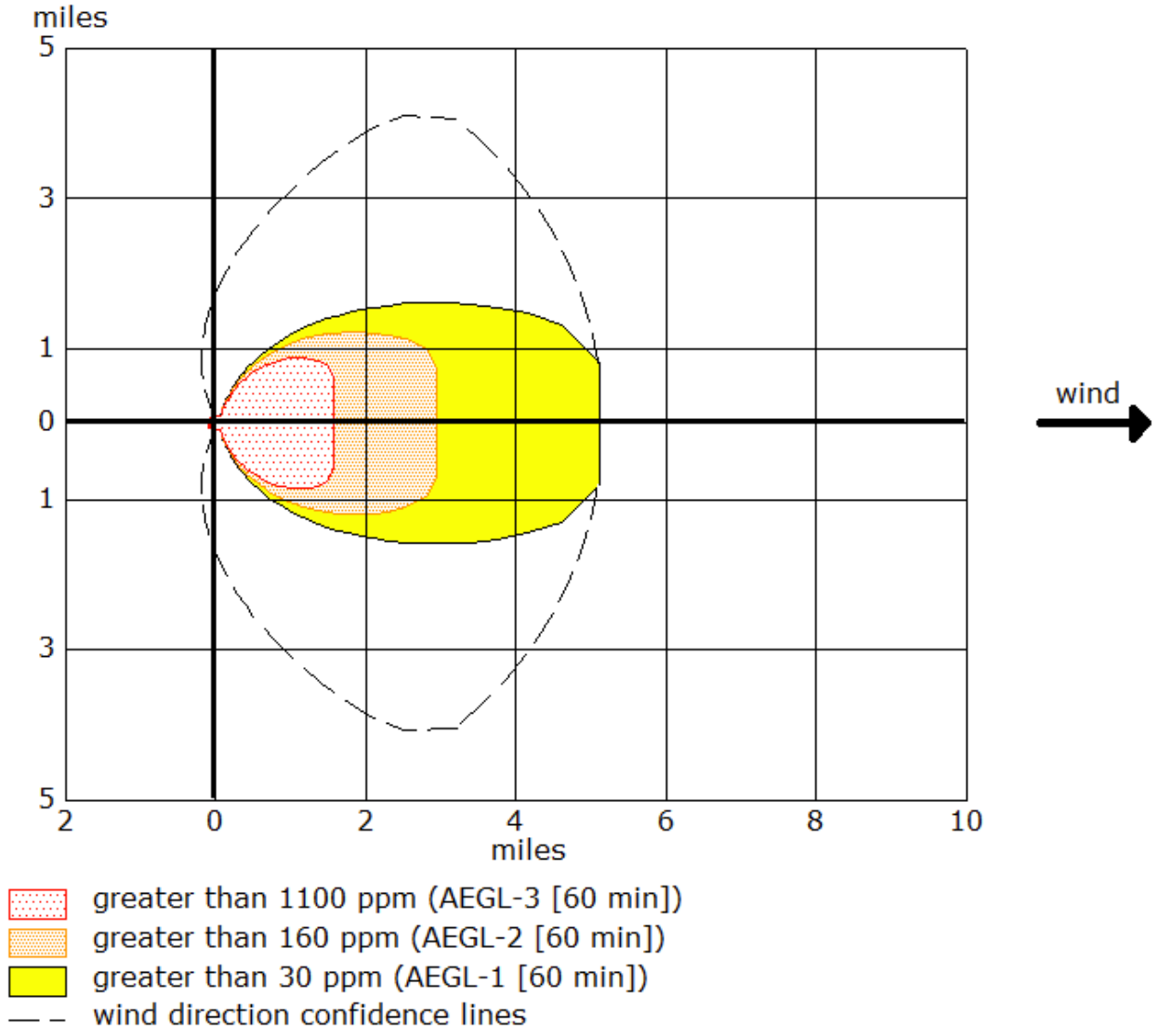

Exhibit 65. Toxic Threat Plume Footprint Generated by ALOHA

For this scenario, moderate atmospheric and climatic conditions with a slight breeze from the west-southwest were assumed, and the ALOHA atmospheric modeling parameters were based on the actual conditions at the location when the model was run including wind speed of 4 mph. The temperature was 81°F with 73% humidity and clear skies.

This modeled release was based on a leak from a 2.5 feet-diameter hole in the tank. According to the ALOHA parameters, approximately 1,050 pounds of material would be released per minute. Exhibit 66 shows the arbitrary location of the release.

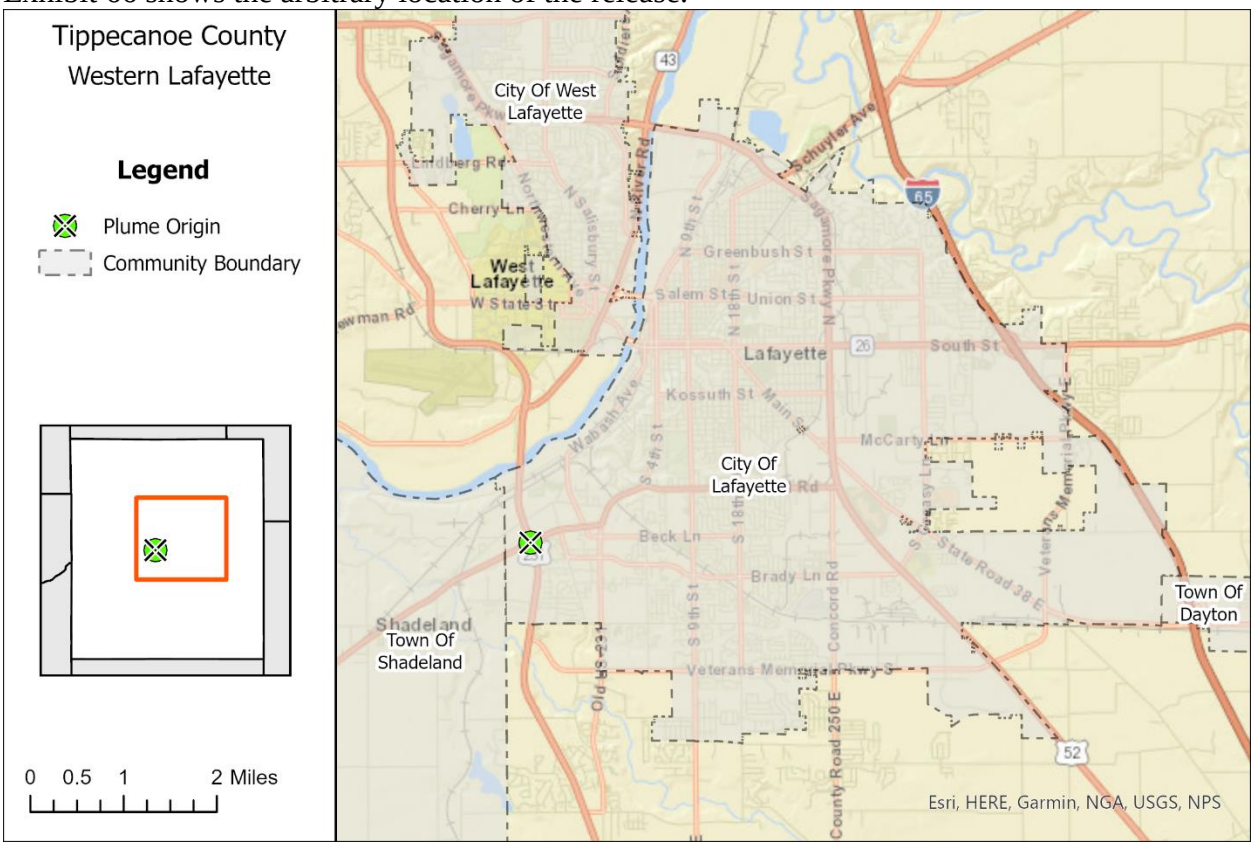

Exhibit 66. Location of Release

The Tippecanoe County Building Inventory was added to ArcMap and overlaid with the threat zone footprint. The Building Inventory was then intersected with each of the three footprint areas to classify each point based upon the plume footprint in which it is located. Exhibit 67 depicts the Tippecanoe County Building Inventory after the intersect process.

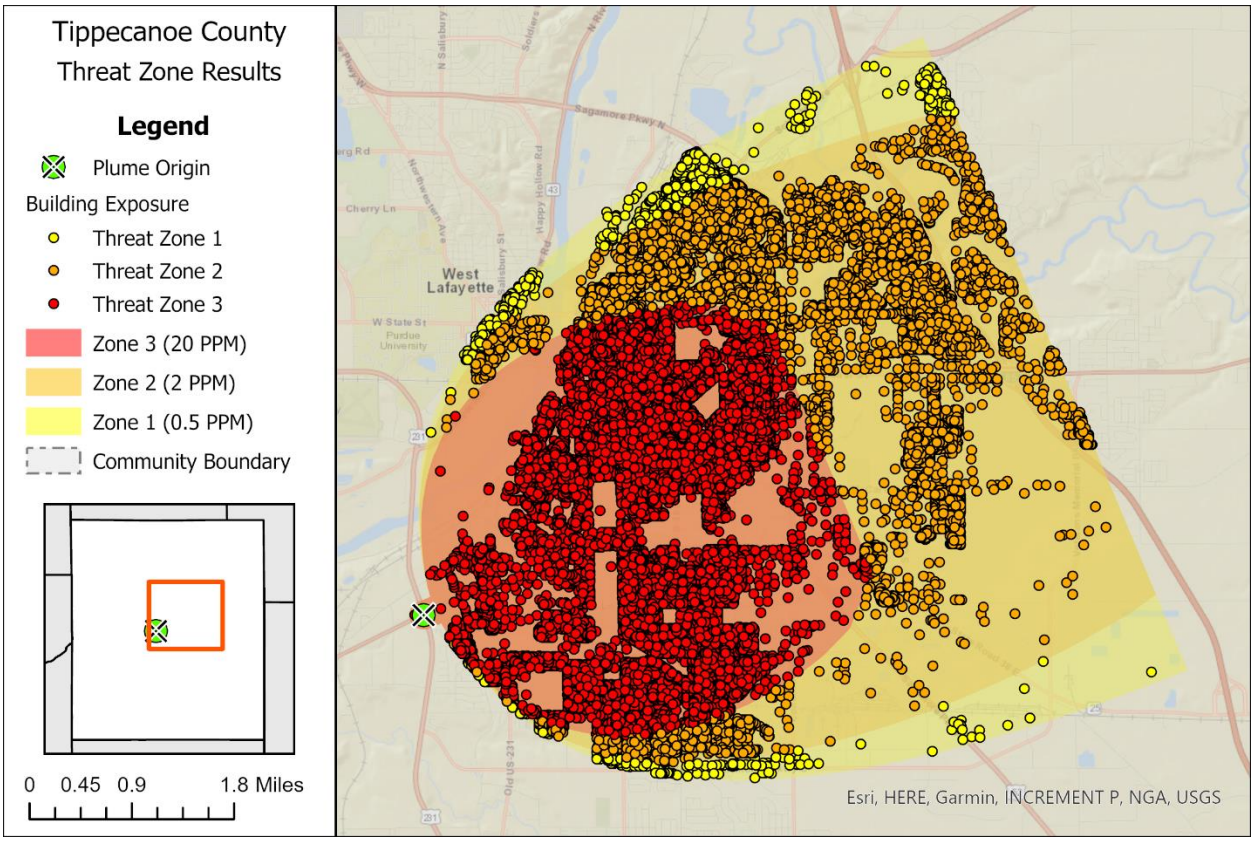

Exhibit 67. Location of Release and Building Inventory by Threat Zone

The results of the analysis against the Building Inventory counts are depicted in Exhibit 68.

	Number of Buildings within the Hazmat Plume		
Occupancy	**AEGL 3 (most severe)**	**AEGL 2**	**AEGL 1 (least severe)**
Agriculture	-	11	6
Commercial	830	555	144
Education	9	-	-
Government	30	17	5
Industrial	28	22	10
Religious	152	85	11
Residential	11,490	6,805	708
Total	**12,539**	**7,495**	**884**

Exhibit 68. Estimated Exposure for all Threat Zones

Exhibit 69 summarizes the replacement costs of buildings within each threat zone. Values represent only those portions of each zone that are not occupied by other zones.

	Replacement Cost of Buildings within the Hazmat Plume		
Occupancy	**AEGL 3 (most severe)**	**AEGL 2**	**AEGL 1 (least severe)**
Agriculture	-	$2,302,815	$1,131,628

Commercial	$288,057,640	$232,196,952	$52,161,563
Education	$2,456,515	-	-
Government	$8,895,769	$4,769,820	$1,433,644
Industrial	$37,098,407	$29,895,026	$21,688,070
Religious	$130,662,216	$66,858,417	$13,071,064
Residential	$1,933,862,456	$1,235,071,236	$141,573,786
Total	**$2,401,033,003**	**$1,571,094,266**	**$231,059,754**

Exhibit 67. Estimated Replacement Cost for all Threat Zones

Essential Facilities

All facilities affected by the plume have been mapped and labeled in Exhibit 67. Exhibit 68 lists all affected essential facilities.

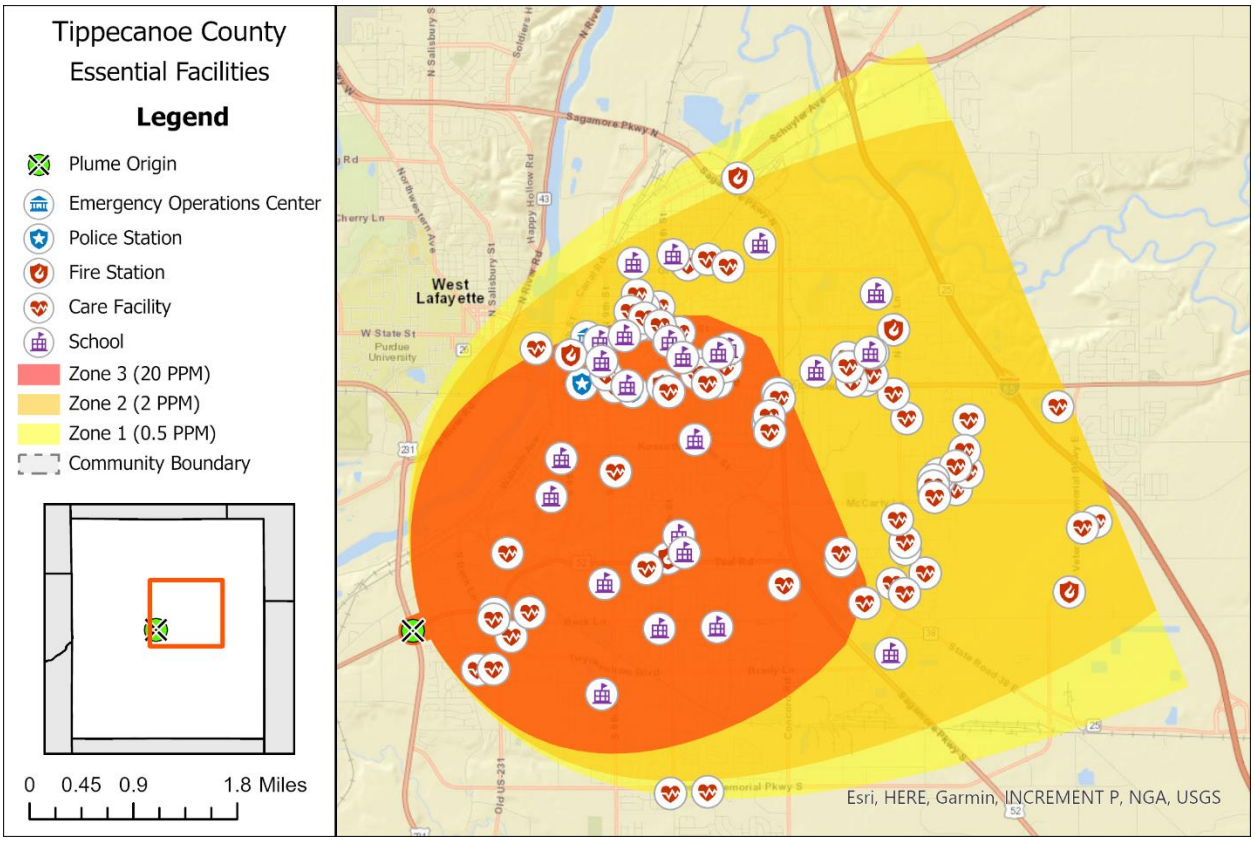

Exhibit 69. Essential Facilities Located in Threat Zone

Facility Type	Name	Address	City
Police Station	Lafayette Police Dept	20 N 6Th St # 2	Lafayette
Police Station	Lafayette Police	1301 South Street	Lafayette
Hazardous Materials Facility	Tippecanoe County EMA	629 North 6Th Street	Lafayette
School	Saint James Lutheran School	615 N 8Th St	Lafayette
School	Saint Mary Cathedral School	1200 South St	Lafayette
School	Ivy Tech Main Campus	3101 Creasy Lane	Lafayette
School	GLASS at Linwood Preschool	1415 Ball Street	Lafayette
School	Oakland High School	1100 Elizabeth Street	Lafayette
School	The Excel Center- Lafayette	615 N 18Th St	Lafayette
School	Apostolic Christian Academy	100 Murphy St	Lafayette
School	Follow The Child Montessori	115 N Farabee Dr Ste A & B1	Lafayette
School	T C Harris School At Idtc Lafayette	3700 Rome Dr	Lafayette
School	Lafayette Christian School	525 N 26Th St	Lafayette

Facility Type	Name	Address	City
School	Glen Acres Elementary School	3767 Kimberly Dr	Lafayette
School	Miami Elementary School	2401 Beck Ln	Lafayette
School	Thomas Miller Elementary School	700 S 4Th St	Lafayette
School	Murdock Elementary School	2100 Cason St	Lafayette
School	Jefferson High School	1801 S 18Th St	Lafayette
School	Sunnyside Middle School	2500 Cason St	Lafayette
School	Tecumseh Middle School	2101 S 18Th St/Teal Rd	Lafayette
School	Edgelea Elementary School	2910 S 18Th St	Lafayette
School	Saint Boniface Middle School	813 North St	Lafayette
School	Saint Lawrence Elementary School	1902 Meharry St	Lafayette
School	Oakland Elementary School	611 S 21St St	Lafayette
School	Vinton Elementary School	3101 Elmwood Ave	Lafayette
School	Central Catholic Jr-Sr High School	2410 S 9Th St	Lafayette
School	Amelia Earhart Elem School	3280 S 9Th St	Lafayette
Care Facility	Liberty Dialysis Lafayette II	1020 N 18Th St	Lafayette
Care Facility	Franciscan St Elizabeth Health - Lafayette	1501 Hartford St	Lafayette
Care Facility	St Anthony Health Care	1205 N 14Th St	Lafayette
Care Facility	Wabash Center Inc	2000 Greenbush St	Lafayette
Care Facility	Pay Less J 843	2200 Greenbush St	Lafayette
Care Facility	Lafayette Bickford Cottage	3633 Regal Valley Dr	Lafayette
Care Facility	Sam's Club	3819 State Rd 26 E	Lafayette
Care Facility	Walgreens	130 S Creasy Ln	Lafayette
Care Facility	CVS		
Care Facility	Med Express	102 Sagamore Pky S	Lafayette
Care Facility	Digby House	167 W Cord 240 S	Lafayette
Care Facility	Pay Less J 822	65 Beck Ln	Lafayette
Care Facility	Pay Less J 827	2513 Maple Point Dr	Lafayette
Care Facility	Sagamore Surgical Services Inc	2320 Concord Rd	Lafayette
Care Facility	Franciscan Health Lafayette E	1701 S Creasy Ln	Lafayette
Care Facility	Lafayette Regional Rehabilitation Hospital	950 Park Blvd E	Lafayette
Care Facility	Southerncare Lafayette	935 Mezzanine Dr	Lafayette
Care Facility	Dsi Lafayette Dialysis	915 Mezzanine Dr	Lafayette

Facility Type	Name	Address	City
Care Facility	Sycamore Springs	833 Park East Blvd	Lafayette
Care Facility	Rem-Indiana Inc	926 S 10Th St	Lafayette
Care Facility	Community Ventures In Living Ltd	401 S Earl Ave 4Th Fl	Lafayette
Care Facility	Wal Mart 1547	4205 Commerce Dr	Lafayette
Care Facility	Csl Plasma Inc	400 Brown St	West Lafayette
Care Facility	Reliance Home Care	615 N 18Th St	Lafayette
Care Facility	Rosewalk Village At Lafayette	1903 Union St	Lafayette
Care Facility	St Elizabeth Home Health Care	1415 Salem St	Lafayette
Care Facility	Unity Surgical Center	1411 S Creasy Ln	Lafayette
Care Facility	IU Health Arnett	5165 McCarty Ln	Lafayette
Care Facility	Home Instead Senior Care Of Indianapolis	325 S Earl Ave	Lafayette
Care Facility	Meijer 137	4901 St Road 26 E	Lafayette
Care Facility	Serenity Hospice	5 N 10Th St	Lafayette
Care Facility	Wellbound Of Lafayette	2 Executive Dr	Lafayette
Care Facility	Brightstar Of Lafayette Indiana	25 Executive Dr	Lafayette
Care Facility	Provision Living	839 Main St	Lafayette
Care Facility	St Mary Healthcare Center	2201 Cason St	Lafayette
Care Facility	Advanced Surgery Center LLC	1400 Teal Rd	Lafayette
Care Facility	Signature Healthcare Of Lafayette	300 Windy Hill Dr	Lafayette
Care Facility	Arnett/IU Urgent Care Facility	1 Walter Scholler Dr	Lafayette
Care Facility	Walgreens	2800 Old Us Hwy 231 S	Lafayette
Care Facility	CVS	2806 Us231 S	Lafayette
Care Facility	Clarian-Arnett Health Outpatient	1327 Veterans Memorial Pky E	Lafayette
Care Facility	Aster Place		Lafayette
Care Facility	Unity Immediate Care Facility	1321 S Creasy Lane	Lafayette
Care Facility	Creasy Springs Health Campus	1730 S Creasy Lane	Lafayette
Care Facility	The Springs at Lafayette	2400 South Street	Lafayette
Care Facility	Tippecanoe County Wic Program	1322 Tippecanoe St	Lafayette
Care Facility	IU Health Arnett Family Medicine	1500 Salem St	Lafayette

Facility Type	Name	Address	City
Care Facility	Five Star Residences of Lafayette	250 Shenandoah Dr	Lafayette
Care Facility	BeeHive Homes Assisted Living	830 Park E Blvd	Lafayette
Care Facility	Glasswater Creek of Lafayette	208 Beck Ln	Lafayette
Care Facility	CVS Pharmacy	1725 Salem St	Lafayette
Care Facility	Walgreens Pharmacy	1801 South St	Lafayette
Care Facility	Genoa Healthcare	415 N 26th St #100	Lafayette
Care Facility	Parkside Pharmacy	2200 Ferry St	Lafayette
Care Facility	CVS Pharmacy	2 Shenandoah Dr	Lafayette
Care Facility	Target-CVS Pharmacy	3630 South St	Lafayette
Care Facility	CVS Pharmacy	3630 S 18th St	Lafayette
Care Facility	PhysioCare Home Healthcare LLC	625 S Earl Ave Suite C	Lafayette
Care Facility	Indiana Developmental Training Center	3700 Rome Dr	Lafayette
Care Facility	Anew Home Care	210 Professional Ct	Lafayette
Care Facility	Rest Assured Home Health Care	180 Professional Ct	Lafayette
Care Facility	Comfort Keepers of Lafayette	1803 S Creasy Ln	Lafayette
Care Facility	Apria Home Healthcare	1160 S Creasy Ln Ste 6	Lafayette
Care Facility	Home Instead Health Care	976 Mezzanine Dr Suite A	Lafayette
Care Facility	Adaptive Nursing and Healthcare Services	938 Mezzanine Dr Suite A	Lafayette
Care Facility	Help At Home Care	958 Mezzanine Dr	Lafayette
Care Facility	IU Health Home Care Lafayette	3900 McCarty Ln #103	Lafayette
Care Facility	IU Health Arnett Medical Offices	2600 Greenbush St	Lafayette
Care Facility	Riggs Community Health Center	2316 South St	Lafayette
Fire Station	Lafayette Fire Dept	443 N. 4Th St	Lafayette
Fire Station	Lafayette Fire Department Station 5	750 N Creasy Ln	Lafayette
Fire Station	Lafayette Fire Department Station 6	2561 Schuyler Ave	Lafayette
Fire Station	Lafayette Fire Department Station 7	2150 S 18Th St	Lafayette

Facility Type	Name	Address	City
Fire Station	Lafayette Fire Department Station 2	800 Erie Street	Lafayette
Fire Station	Lafayette Fire Department Station 3	1710 South Street	Lafayette
Fire Station	Lafayette Fire Department Station 9	1757 South 475 East	Lafayette

Exhibit 70. Essential Facilities

3.3.8.7 Community Development Trends and Future Vulnerability

Because the hazardous material hazard events may occur anywhere within the county, future development will be impacted, especially development along major roadways. The major transportation routes and the industries located in Tippecanoe County pose a threat of dangerous chemicals and hazardous materials release.

1.1.1.1 Relationship to other Hazards

Flood- Hazmat incidents are likely when flood incidents occur. Hazardous material storage containers can become compromised due to flooding.

3.3.9 Dam and Levee Failure

3.3.9.1 Hazard Definition for Dam and Levee Failure

Dams are structures that retain or detain water behind a large barrier. When full or partially full, the difference in elevation between the water above the dam and below creates large amounts of potential energy, creating the potential for failure. The same potential exists for levees when they serve their purpose, which is to confine flood waters within the channel area of a river and exclude that water from land or communities land-ward of the levee. Dams and levees can fail due to either 1) water heights or flows above the capacity for which the structure was designed; or 2) deficiencies in the structure such that it cannot hold back the potential energy of the water. If a dam or levee fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage.

Many communities view both dams and levees as permanent and infinitely safe structures. This sense of security may well be false, leading to significantly increased risks. Both downstream of dams and on floodplains protected by levees, security leads to new construction, added infrastructure, and increased population over time. Levees in particular are built to hold back flood waters only up to some maximum level, often the 100-year (1% annual probability) flood event. When that maximum is exceeded by more than the design safety margin, the levee will be overtopped or otherwise fail, inundating communities in the land previously protected by that levee. It has been suggested that climate change, land-use shifts, and some forms of river engineering may be increasing the magnitude of large floods and the frequency of levee failure situations.

In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. Many structures across the U.S. have been under-funded or otherwise neglected, leading to an eventual day of reckoning in the form either of realization that the structure is unsafe or, sometimes, an actual failure. The threat of dam or levee failure may require substantial commitment of time, personnel, and resources. Since dams and levees deteriorate with age, minor issues become larger compounding problems, and the risk of failure increases.

Low-Head Dams

Another type of dam low-head, or in-channel, dams can present a safety hazard to the public because of their ability to trap victims in a submerged hydraulic jump formed just downstream from the dam. Recent deaths and injuries around these structures in the state have brought the attention of this issue to the surface for local, state and federal officials. Current initiatives led by the Indiana Silver Jackets—a multi-agency coalition that leverages efforts to address natural hazards—have focused on the identification of these dams statewide, as well as various efforts to notify the public on their dangers. There are no known low-head dams in Tippecanoe County.

Non-Levee Embankments

Along with accredited levees regulated by federal agencies, there are also what are referred to as Non-Levee Embankments (NLE), which are typically parallel to the direction of natural flow. An embankment is an artificial mound of soil or broken rock that supports railroads, highways, airfields, and large industrial sites in low areas, or impounds water. NLEs are often highways or railroads built on fill in low lying areas and thus tend to impose lateral constraints on flood flows, and typically contain the following characteristics:

- NLEs are elevated linear features adjacent to waterways and within the floodplain.
- They are typically man-made and include agricultural embankments built by landowners and road and railroad embankments.
- They are levee-like structures, but are not certified or engineered to provide flood protection.

The National Committee on Levee Safety estimates that the location and reliability status of 85% of the nation's NLEs are unknown. In Indiana, the majority of NLEs are unidentified and are typically not maintained. NLEs impose lateral constraints on flood flows, reducing the floodplain storage capacity and increasing the flood velocity. As a result, downstream flooding and the potential for stream erosion can increase. As such, NLE's can give a false sense of security and protection to the people residing near NLEs. For these reasons, it is extremely important to map where these features are located.

Living with levees is a shared responsibility. While levees are in operation, maintaining levee systems are the levee sponsor responsibility. Local officials are adopting protocols and procedures for ensuring public safety and participation in the NFIP.

3.3.9.2 Dam and Levee Failure History in Tippecanoe County

According to the Tippecanoe County Hazard Analysis, there are no records or local knowledge of any dam or certified levee failure in the county.

3.3.9.3 Geographic Location for Dam and Levee Failure

A review of the IDNR dam database revealed 4 state regulated dams located in Tippecanoe County and no federally regulated dam. Exhibit 69 summarizes the dam information and Exhibit 70 maps the dams on a county level. High hazard and in channel dams are individually mapped in the vulnerability section. A review of the Army Corp of Engineers (USACE) National Levee Database identified three certified levees with a total length of 6 miles. The average age of these levees is 49 years. Two of these levees are in the northeastern corner of the county near Americus along the Wabash River. The third levee is the City of Lafayette wastewater treatment plant levee.

Exhibit 71 is a table of the IDNR dams in the county and Exhibit 72 is a map.

Dam Name	Hazard Rank	EAP?
Robert Franklin Pond Dam	Low	No
Pretty Prairie Creek Road Dam	Significant	No
Marsh Lake Tippecanoe Co. Highway Dam	Significant	No
Treece Lake Dam	High	No

Exhibit 71. Indiana Department of Natural Resources Dam Inventory

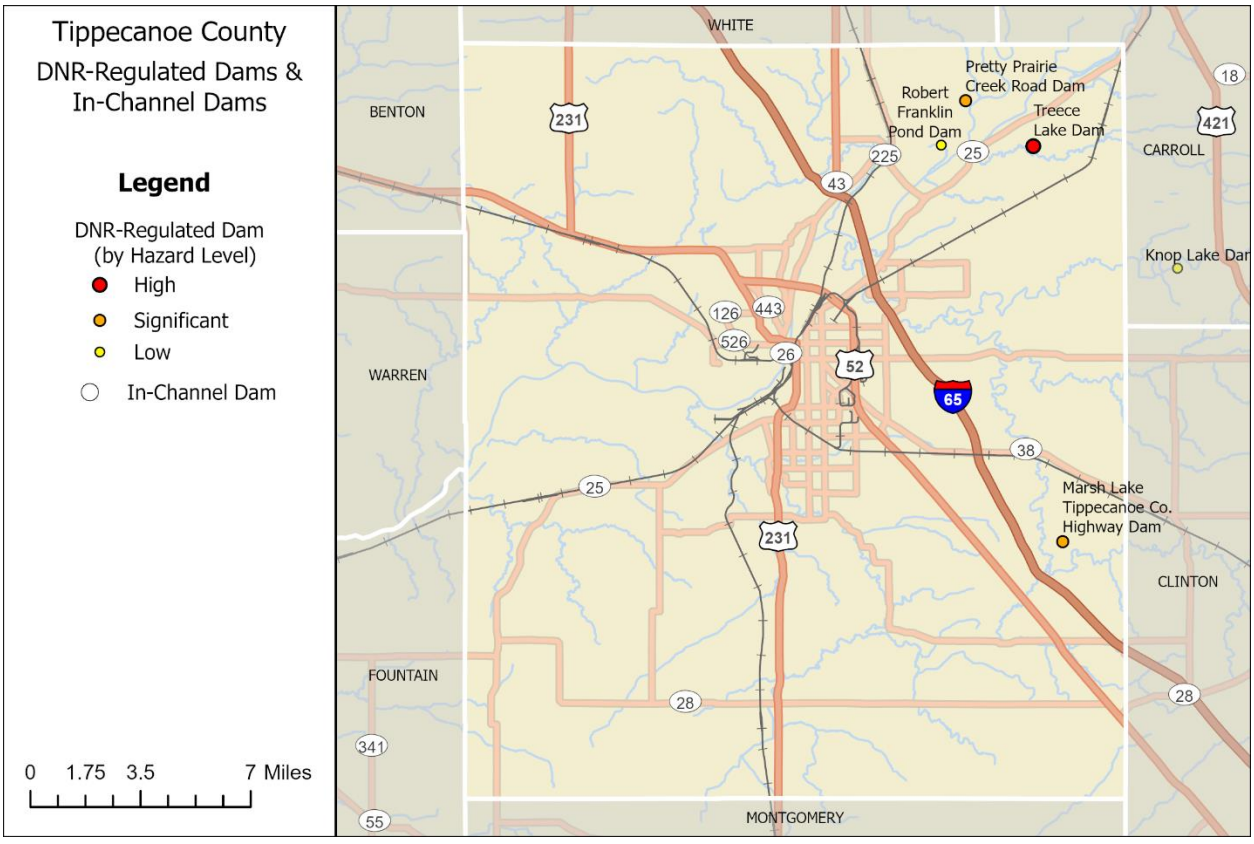

Exhibit 72. Tippecanoe County DNR Regulated Dams with Hazard Classification

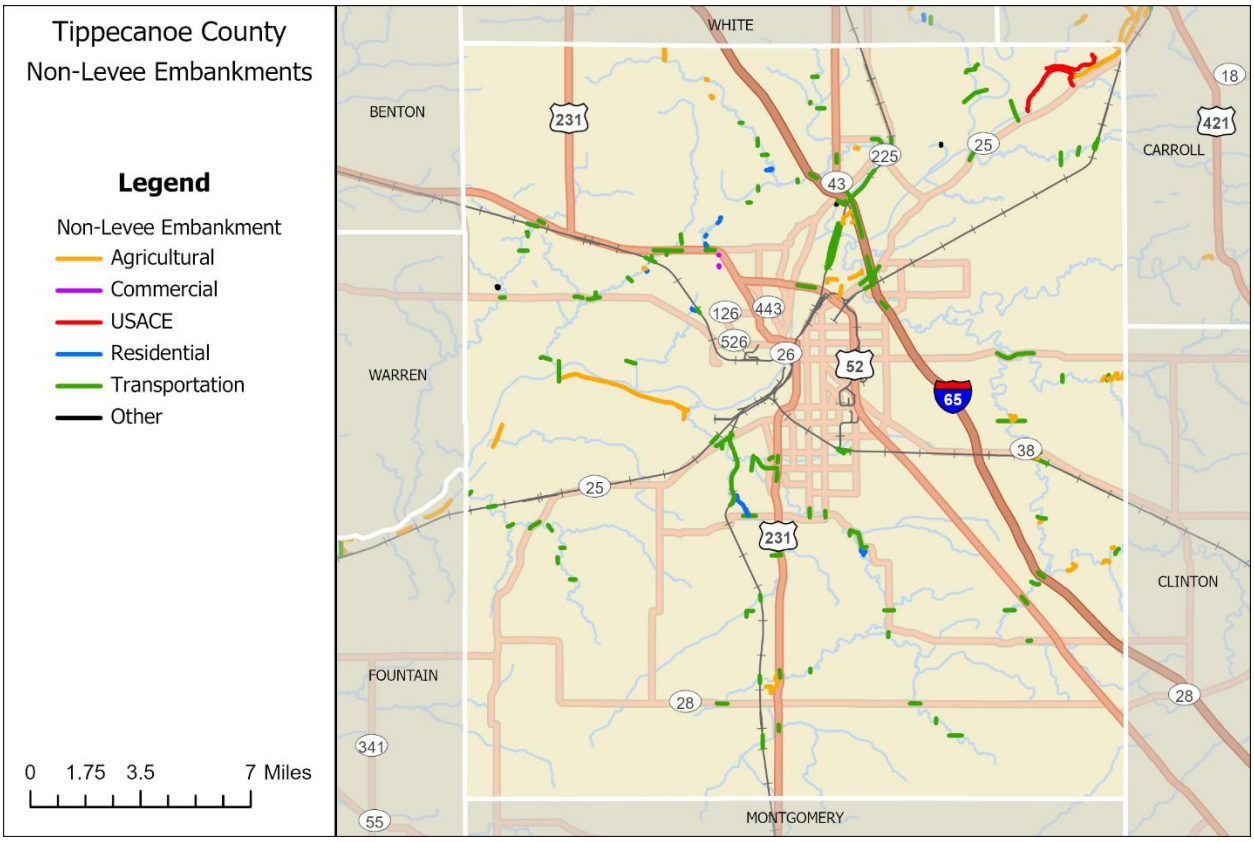

Exhibit 73. Tippecanoe County Non-Levee Embankments

There are 189 non-levee embankments in the county mapped in Exhibit 73.

3.3.9.4 Hazard Extent for Dam and Levee Failure

When dams are assigned the low (L) hazard potential classification, it means that failure or incorrect operation of the dam will result in no human life losses and no economic or environmental losses. Losses are principally limited to the owner's property. Dams assigned the significant (S) hazard classification are those dams in which failure or incorrect operation results in no probable loss of human life; however it can cause economic loss, environmental damage, and disruption of lifeline facilities. Dams classified as significant hazard potential dams are often located in predominantly rural or agricultural areas, but could be located in populated areas with a significant amount of infrastructure. Dams assigned the high (H) hazard potential classification are those dams in which failure or incorrect operation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure.

According to IDNR and the National Inventory of Dams, one dam was classified as high hazard, and was not recorded as having an Emergency Action Plan (EAP). An EAP is not required by the State of Indiana but is strongly recommended in the 2007 Indiana Dam Safety & Inspection Manual.

Accurate mapping of the risks of flooding behind levees depends on knowing the condition and level of protection the levees actually provide. FEMA and the USACE are working together to make sure that flood hazard maps clearly reflect the flood protection capabilities of levees, and that the maps accurately represent the flood risks posed to areas situated behind them. Levee owners—usually states, communities, or in some cases private individuals or organizations—are responsible for ensuring that the levees they own are maintained according to their design. In order for a dam or levee to be considered a creditable flood protection structure on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation, and maintenance standards for protection against the one-percent-annual-chance flood.

3.3.9.5 Community Development Trends and Future Vulnerability

The county recognizes the importance of maintaining its future assets, infrastructure, and residents. Inundation maps can highlight the areas of greatest vulnerability in each community. The Tippecanoe County Planning Commission reviews new development for compliance with the local zoning ordinance.

3.3.9.6 Relationship to Other Hazards

Flooding – Flooding is typically the leading cause of dam or levee failure incidents.
Drought – Property owners living around dams may have problems accessing boating equipment during times of drought.

3.3.10 Wildfire

3.3.10.1 Hazard Definition for Wildfire

The hazard extent of wildfires is greatest in the heavily forested areas of southern Indiana. The IDNR Division of Forestry assumes responsibility for approximately 7.3 million acres of forest and associated wild lands, including state and privately-owned lands. Indiana's wildfire seasons occur primarily in the spring—when the leaf litter on the ground dries out and before young herbaceous plants start to grow and cover the ground (green up)—and in the fall—after the leaves come down and before they are wetted down by the first heavy snow. During these times, especially when weather conditions are warm, windy, and with low humidity, cured vegetation is particularly susceptible to burning. When combined, fuel, weather, and topography, present an unpredictable danger to unwary civilians and firefighters in the path of a wildfire. Human action can not only intervene to stop the spread of wildfires, but can also mitigate their onset and effects. Forest and grassland areas can be cleared of dry fuel to prevent fires from starting and can be burned proactively to prevent uncontrolled burning.

3.3.10.2 Wildfire History in Tippecanoe County

There have been no recently recorded wildfires or damages from wildfires reported in Tippecanoe County.

3.3.10.3 Geographic Location for Wildfire

Wildfires can affect any area of the county that may be experiencing a drought.

3.3.10.4 Hazard Extent for Wildfire

Wildfires can be widespread or localized events.

3.3.10.5 Vulnerability Analysis for Wildfire

Residential, commercial and recreational areas are all vulnerable to wildfires. Areas of concentrated vegetation such as national parks or forests can be exceptionally vulnerable to wildfire.

3.3.10.6 Community Development Trends and Future Vulnerability

Because wildfire hazard events may occur anywhere within the county, future development will be impacted. Major future development areas will be supplied with water distribution, including hydrants for fire protection.

3.3.10.7 Relationship to other Hazards

Flooding and Erosion – Wildfires can completely eliminate vegetation and pose an increased risk to flooding and erosion effects.
Drought and Extreme Heat – Dry, hot conditions can reduce the protective moisture of woodlands and increase the risk of wildfire.
Hazardous Material Release – Storage tanks carrying chemicals including chlorine, anhydrous ammonia, and fuel tanks located at farms pose an increased risk to wildfire ignition.

3.3.11 Infectious Agents or Harmful Organisms

3.3.11.1 Hazard Definition for Infectious Agents or Harmful Organisms

The spread of harmful organisms and infectious agents are occasionally overlooked potential natural hazards that can be exacerbated following other natural disasters. This hazard can include invasive species, such as the Emerald ash borer, or vector-borne diseases, such as West Nile fever.

Emerald Ash Borer

The Emerald ash borer (EAB), Agrilus planipennis, is an exotic beetle thought to have arrived in the United States by 2002 and was discovered near Detroit, Michigan. Indiana was one of the next states recognized to have the beetle, having been discovered in northern Indiana in 2004. The adult beetles do not pose harm to the ash trees, as they nibble on ash foliage. The immature, or larvae stage, feed on the inner bark of the ash trees, disrupting its ability to transport nutrients and water. The EAB is responsible for killing millions of ash trees in North America. It has cost municipalities, property owners, nursery owners, and forest industries millions of dollars.

Vector-Borne Illness

Vector-borne illnesses are caused by infectious microorganisms that are transmitted to people via living organisms including blood-sucking arthropods such as mosquitos, ticks, fleas, and spiders. Natural disasters, particularly meteorological events such as cyclones, hurricanes, and flooding, can influence transmission of vector-borne disease. The crowding of infected and vulnerable hosts, a debilitated public health infrastructure, and disruptions of ongoing control processes are risk factors for transmission of vector-borne disease. The Indiana State Department of Health (ISDH)

identifies sleeping sickness (Eastern equine encephalitis virus), La Crosse encephalitis (La Crosse virus), St. Louis encephalitis (St. Louis encephalitis virus), West Nile fever (West Nile virus), and dengue fever (dengue virus), as mosquito-borne diseases that Hoosiers should take steps to protect themselves against.

The health department has also reported more than 200 cases of tick-borne illness in Indiana in 2016 alone. The ISDH highlighted Lyme disease, Rocky Mountain spotted fever, and Erlichiosis as tick-borne diseases particularly prevalent in Indiana. Over the past few years, Indiana has experienced a rise in tick-borne Lyme disease. There were approximately 112 confirmed cases of Lyme disease in 2014, and 155 in 2018. Increased summer tick populations frequently follow mild winters, and back-to-back mild winters can cause a notable surge in tick numbers, along with the diseases they carry. In June of 2017, a young Indiana girl died after contracting Rocky Mountain spotted fever from a tick bite. Recently, a new tick-transmitted virus has made headlines through the state. The Centers for Disease Control confirmed two cases of Heartland virus in Indiana. Both infected patients survived.

3.3.11.2 Infectious Agents or Harmful Organisms History in Tippecanoe County

Emerald Ash Borer

EAB has been detected in Tippecanoe County, Indiana. As of 2017, the entire state of Indiana lies within the Federal quarantine boundaries and Tippecanoe County lies within the state-quarantined area.

Vector-Borne Illness

Mosquitoes carrying West Nile virus have been found in Tippecanoe County. Most people who get infected with West Nile virus will have either no symptoms or mild symptoms, but a few individuals may contract a more severe form of the disease.

3.3.11.3 Geographic Location for Infectious Agents or Harmful Organisms

Emerald Ash Borers are most commonly found in forested areas but can also negatively impact neighborhoods or any other areas that have trees.

Mosquitos are drawn to areas of standing water and are commonly most active at dusk and dawn; however, all areas are affected by mosquito populations.

3.3.11.4 Hazard Extent for Infectious Agents or Harmful Organisms

An exposure analysis identifies the existing and future assets located in identified hazard areas. The areas with reported identification of the EAB in Tippecanoe County are identified Exhibit 74 with magenta dots. The points shown are collected from DNR annual surveys and from the DNR Division of Entomology and Plant Pathology field staff. According to the DNR, a live larva must be collected from an ash tree and identified by a trained specialist in order to confirm the presence of EAB at the marked location. There may be more locations with EAB that have not been identified.

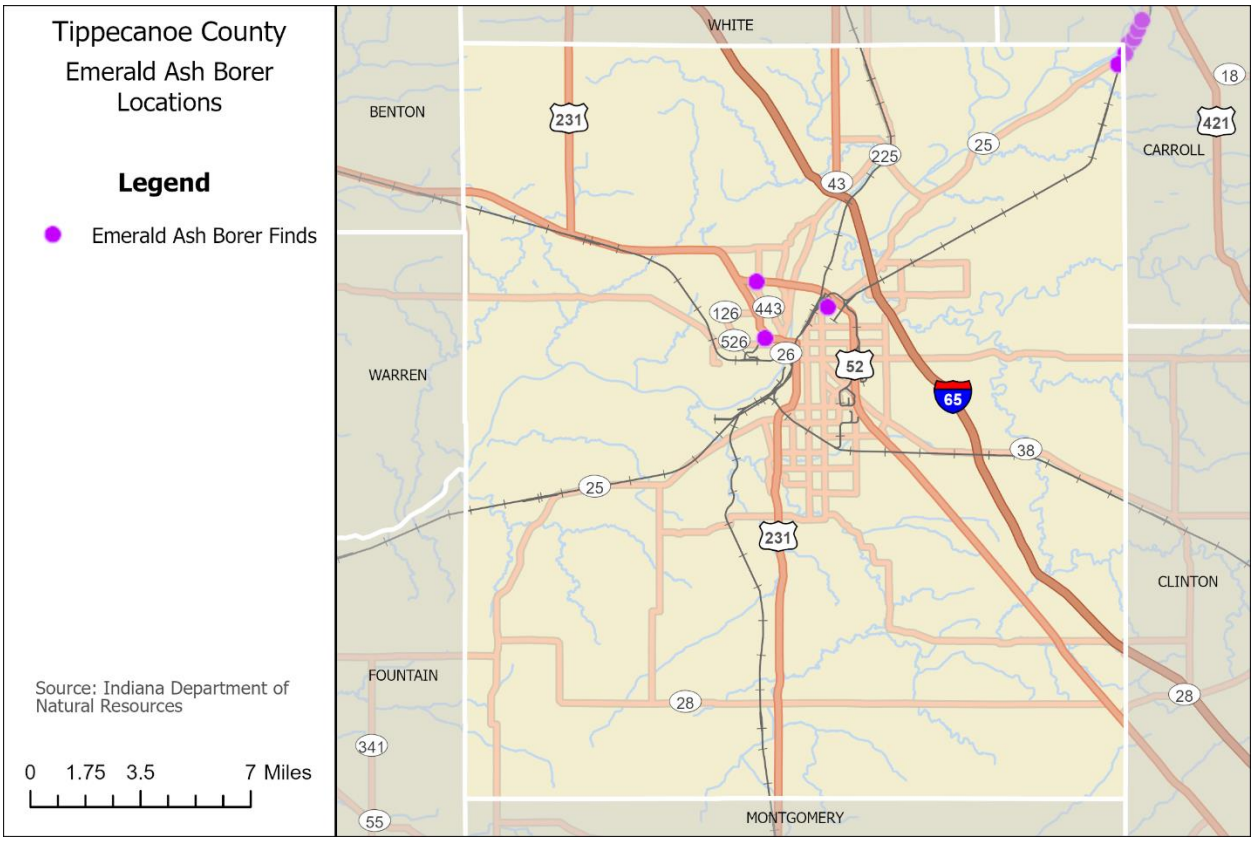

Exhibit 74. Emerald Ash Borer in Tippecanoe County (Map courtesy of IDNR)

3.3.11.5 Vulnerability Analysis for Infectious Agents or Harmful Organisms Hazard

All communities can be potentially at risk for an epidemic. It is a probable to experience increased risk during hazards the cause displacement, contamination of the water supply, and/or deprivation of essential utilities, or when residents are not exposed to educational resources outlining preventive steps.

3.3.11.6 Community Development Trends and Future Vulnerability

Future development will remain vulnerable to these events. EABs have killed millions of ash trees in Indiana, Michigan, Illinois, Ohio, and Ontario and will continue to do so until the insects are effectively contained or eliminated, or a strain of more resistant trees is developed.

According to the National Institute of Allergy and Infectious Diseases, tick-borne illnesses will continue to remain a problem as people build homes in wilderness areas where ticks and their animal hosts live; however, urban environments can also host ticks and the pathogens they can transmit. Eliminating areas of standing water may help diminish the disease-carrying mosquito population by removing or treating stagnant bodies of water that serve as mosquitos' breeding grounds.

3.3.11.7 Relationship to other Hazards

The risk for infectious disease transmission is primarily associated with displacement and the characteristics of the displaced population, the proximity of sterile water and functional restrooms, the nutritional status of the displaced, the level of immunity to vaccine-preventable infections, and the availability of access to healthcare services.

Flooding – Increased risk of vector-borne diseases. EAB-damaged trees may pose a risk for increased logjam events. In the aftermath of flooding, a plethora of standing water combined with a possibly weakened health infrastructure and an interruption of ongoing control programs increases the risk factors for vector-borne disease transmission. While initial flooding may wash away existing mosquito-breeding sites, standing water caused by heavy rainfall or overflow of rivers can create new breeding sites.

Earthquake – In the aftermath of earthquakes, some populations have experienced infection outbreaks associated with increased exposure to airborne dust from landslides.

Tornadoes – Natural disasters like tornadoes, which impact communities on a large-scale and cause displacement, have been associated with an increased risk in disease.

Utility Failure – Power outages and the disruption of water treatment and supply plants can affect the proper functioning of health facilities and has also been linked with an increase in diarrheal illness.

3.3.12 Active Assailant

3.3.12.1 Active Assailant Definition

Federal agencies, including the Federal Bureau of Investigations (FBI), the US DHS, FEMA, and others have agreed upon the definition of an Active Assailant: an individual actively engaged in killing or attempting to kill people in a confined and populated area. In many cases, specific victims are not targeted, simply a high-profile location, an area where numerous people have gathered, or a facility with which the assailant is familiar, but harbors ill feelings toward. Often, assailants may utilize firearms, but attacks have also been carried out using vehicle ramming, chemicals, and other weapons designed for mass casualties or mass fatalities.

Recent violent incidents in schools or the workplace have ranged from extreme acts of bullying to armed intruders resulting in multiple injuries, fatalities, and mass chaos. While all acts of school or workplace violence do not have the same cause, many factors leading up to the incident are similar. Some stressors in school-related attacks may include:

- Rejection from peers or family members
- Bouts of significant depression
- Mental illness
- Physical, mental, or sexual abuse
- Changes in policies regarding punishment and disciplinary actions

In addition, factors leading to a workplace attack may include:
Schools and major employers within Tippecanoe County and the individual communities may be the most at risk as a target due to the number of students and/or personnel present at each facility. Direct and indirect effects of an incident of school or workplace violence may include:

- Prolonged work hours or occupations with a high risk of injury
- Little or no recognition of job performance
- Loss of employment
- Bouts of significant depression
- Mental illness
- Drug or alcohol abuse
- Poor social, interpersonal, or communication skills

3.3.12.2 Armed Assailant: Recent Occurrences

While several incidents of school or workplace violence have occurred throughout the United States, few incidents have occurred within Tippecanoe County. However, in 2014, a Purdue student was shot and killed on campus.

Workplace violence has also become more prevalent as numerous instances of disgruntled employees or former employees have sought revenge of some sort by targeting co-workers or employers. In February 2019, five employees and five police officers were wounded by a gunman in Aurora, Illinois.

3.3.12.3 Active Assailant: Assessing Vulnerability

Schools and major employers within Tippecanoe County and the individual communities may be the most at risk as a target due to the number of students and/or personnel present at each facility. Direct and indirect effects of an incident of school or workplace violence may include:
Direct Effects:

- Students, staff, workers, or other populations experiencing injury or death
- Inability for those involved to return to school or work

Indirect Effects:

- Revenue or production loss for businesses involved in or near to the incident scene
- The expense of increased social needs following the incident

Estimating Potential Losses

This hazard is not typically as damaging to structures as it is to populations, so monetary damages associated with the direct effects of the violent acts are difficult to estimate. Indirect effects of such an incident include anxiety and stress related to experiencing the incident or having a family member involved in such an incident, the need for additional counselors to assist people affected by such a hazard, and the potential loss of revenue due to business shut down during or immediately following an incident. In addition to the business or facility directly involved, additional businesses nearby may need to be shut down or evacuated for the safety of their personnel.

3.3.12.4 3.3.12.4 Active Assailant: Relationship to Other Hazards

An active assailant incident will not cause other hazards to occur. It is also not likely that other hazards will directly lead to an incident such as this.

3.3.13 Landslide/Subsidence

3.3.13.1 Landslide/Subsidence Definition

The term landslide includes a wide range of ground movements, such as rockfalls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors. For example, erosion by rivers, glaciers, or ocean waves can cause rock to fall. Rock and soil slopes may be weakened through saturation by snowmelt or heavy rains, earthquakes can create stresses that make weak slopes fail, and excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or man-made structures that may stress weak slopes to the point of collapse.

Land subsidence, according to the USGS, is "a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." Further, there are three processes that contribute to subsidence: compaction of aquifer systems, drainage and subsequent oxidation of organic soils, and dissolution and collapse of susceptible rocks.

3.3.13.2 Landslide/Subsidence: Recent Occurrences

The potential for any landslides or land subsidence within the county was discussed with the county building commissioner. To his knowledge there are no Karst areas, antiquated underground mines, or many existing areas where a landslide could occur. To date, there has not been any landslides or subsidence incidents in Tippecanoe County. The probability of a landslide or subsidence occurring is unlikely resulting in potentially limited damages. Currently, the warning time is minimal, and the duration is also expected to last from less than six hours to less than one day. These incidents are highly unpredictable, and the risk is distributed throughout Tippecanoe County.

Without the presence of Karst geology or antiquated underground mines, Tippecanoe County is at low risk of land subsidence or sinkholes, as there is rather subtle topographic relief within most of the county. The effects of a landslide or subsidence incident may be minimal to extensive in nature and may affect small or broad ranges of land area. Due to collaborative efforts between municipal planning and zoning departments and land mining companies, the risk or vulnerability to impacts from landslides or subsidence has not been increased to areas of new development since the last planning effort.

Within Tippecanoe County, direct and indirect effects may include:
Direct Effects:

- Damages to infrastructure (power lines, roads, bridges)
- Damages to individual properties (homes, cars)

Indirect Effects:

- Increased response time for emergency vehicles
- Losses associated with affected land (crop loss)
- Potential contamination of groundwater resources

Estimating Potential Losses
Due to the unpredictability of this hazard all critical infrastructure and non-critical structures in Tippecanoe County are at risk of damage, including temporary or permanent loss of function. For landslide and subsidence, it is difficult to isolate specific critical infrastructure or non-critical structures that would be vulnerable to damages. However, areas, where karst geology or older underground mines have been identified, may be at a higher risk of property damages caused by such incidents. There are no such areas within Tippecanoe County.

3.3.13.3 Future Considerations

As the populations of the communities in Tippecanoe County continue to grow, it can be anticipated that the number of critical and non-critical structures will also increase. To reduce the vulnerability for damages resulting from a landslide or land subsidence, soil GIS layers should be integrated into the building permit or approval process.

Indirect effects resulting from a landslide or land subsidence incident can include power outages caused by downed tree limbs, increased response times for emergency personnel if transportation routes are damaged, and the potential shutdown of businesses.

The county is working to incorporate fluvial erosion hazards zones into the drainage ordinance. The fluvial erosion hazard (FEH) also represents a significant concern in areas where development and infrastructure are established near natural waterways. Communities must be mindful of the tendency of waterways to shift their position across the landscape over time. By identifying where interaction between human activities and natural waterways exist, communities and individual property owners can better anticipate the potential for FEH damages; making them more resilient to the effects of flooding. This would help limit development in areas for the purpose of protecting public and private property, and public safety and welfare. The most effective way to prevent hazards associated with fluvial erosion is avoidance by limiting future human presence in river corridors.

3.3.13.4 Landslide/Subsidence: Relationship to Other Hazards

A landslide or a subsidence may be the precursor for other hazards. Depending on the location of the incident, material storage containers can become damaged, resulting in a spill or release of materials and potentially contaminating groundwater reserves. Dam failures may occur in much the same fashion if located in the potential hazard areas or resulting from heavy saturation following a rainstorm, heavy snow, or rapid snowmelt.

Similarly, these types of an incident may be caused by hail, thunder, or windstorms and their effects on the soils; an earthquake may release the ground enough to set a slide in motion; or a

flood may add increased soil saturation or weight to at-risk areas increasing the potential for an incident and resulting damages.

4.0 COMMUNITY CAPABILITY ASSESSMENT

This section provides an inventory of existing mitigation efforts in Tippecanoe County and Otterbein. This capability assessment identifies measures that are currently in place, their success rate, and where gaps exist in efforts to mitigate the physical, social, and economic impacts of hazards.

4.1 NFIP PARTICIPATION

Tippecanoe County, Lafayette, West Lafayette, Dayton and Battle Ground are all members of the National Flood Insurance Program (NFIP). The Exhibit 75 lists each participant's NFIP number and the date they joined the program. The only non-NFIP communities in Tippecanoe County is Clarks Hill and Otterbein, though town leadership has recently expressed an interest in pursuing membership. Shadeland became a member in late 2012.

NFIP Participation		
Community	**NFIP Number**	**Effective Date**
Lafayette	180253	November 19, 1980
West Lafayette	180254	January 2, 1981
Battle Ground	180252	January 2, 1981
Tippecanoe County	180428	March 16, 1981
Dayton	180486	February 12, 1982 (NSFHA*)
Shadeland	180603	November 1, 2012

*NSFHA = No Special Flood Hazard Areas

Exhibit 75 NFIP Participation

The Town of Otterbein has its own zoning, building, and subdivision regulations, and has not adopted Tippecanoe County's Unified Zoning Ordinance. OCO §154.08 prevents most development in a flood plain district. Otterbein operates its own Advisory Plan Commission and Board of Zoning Appeals.

4.2 FLOOD INSURANCE CLAIMS

There are a total of 314 flood insurance policies in Tippecanoe County. As of 2021 a total of 319 claims have been made and $3,196,503 has been paid out through the NFIP for the entire county. Exhibit 76 is a summary of flood insurance policies and claims paid to each NFIP community.

Summary of Flood Insurance Policies and Claims		
NFIP Community	**Number of Policies**	**Total Payments**
Lafayette	76	$112,958
West Lafayette	22	$52,349
Battle Ground	7	$120,230
Tippecanoe County	214	$2,910,966
Dayton	NA	NA
Total	**319**	**$3,196,503**

(FEMA, 2021; IDNR 2021)

Exhibit 76 Insurance Policies

4.3 REVIEW AND EVALUATION OF EXISTING PLANS, PROGRAMS, AND PROJECTS

The Planning Committee discussed existing mitigation plans, programs, and projects in terms of the six mitigation measures used by FEMA; prevention, property protection, natural resource protection, emergency services, structural control projects, and public information. The following paragraphs give a brief discussion of FEMA's mitigation goals as well as Tippecanoe County's existing plans and programs. This plan of local programs is intended to be as comprehensive as possible at this time.

What value does mitigation have for my community?
Mitigation creates safer communities by reducing losses of life and property.

Mitigation enables individuals and communities to recover more rapidly from disasters.

Mitigation lessens the financial impact of disasters on individuals, the Treasury, state, local and tribal communities.

Source: FEMA.gov

Prevention

FEMA defines prevention as measures that are designed to keep the problem from occurring or getting worse. Member jurisdictions of the Area Plan Commission currently have long range planning, zoning, and subdivision ordinances that guide or restrict development from known hazardous areas. Shadeland has its own municipal code. All communities participating in this plan prohibit construction in the floodplain. Shadeland requires a 100' setback from the floodplain boundary for new construction. All other jurisdictions in Tippecanoe County require a 25' no-building setback from the floodplain boundary and require that all structures built within the next 75' to be at flood protection grade. In Otterbein OCO §154.08 prevents most development in a flood plain district. Local jurisdictions have tree trimming programs for street trees so that they do not become

safety hazards. There is also a household hazardous waste collection site at the local Solid Waste District. The local subdivision ordinance also requires utility lines in new subdivisions to be buried, which prevents damage from different types of storms.

The US Forest Service defines **riparian buffers** as the aquatic ecosystem and the portions of the adjacent terrestrial ecosystem that directly affect or are affected by the aquatic environment. This includes streams, rivers, lakes, and bays and their adjacent side channels, floodplain, and wetlands. In specific cases, the riparian buffer may also include a portion of the slope that directly serves as streamside habitats for wildlife.

Property Protection

FEMA defines property protection as measures that are used to modify buildings subject to hazard damage rather than to keep a hazard away. The Unified Zoning Ordinance, adopted by all communities except Shadeland and Ottberein, requires all new mobile/manufactured home communities to include a tornado shelter for residents. Requiring an additional setback from the floodplain boundary helps ensure the future safety of buildings built near waterways should the floodplain change. The City of Lafayette has established a well-head protection area for city wells.

Natural Resource Protection

FEMA defines natural resource protection as opportunities to preserve and restore natural areas and their function to reduce the impact of hazards. Tippecanoe County SWCD encourages agricultural landowners to implement filter strips along drainage ditches and riparian buffers along streams and rivers. The prohibition of the construction of walled structures in the floodplain also helps ensure the area is as natural as possible. Tippecanoe County, Lafayette, West Lafayette, Dayton, Battle Ground, Purdue University and Ivy Tech State College are MS4 communities and have adopted a stormwater ordinance to address sediment and erosion control as well as stormwater management measures. The new stormwater ordinance also includes a no net loss in the floodplain component that requires compensatory storage for fill dirt added to areas in the floodplain. The stormwater ordinances plan to minimize development in fluvial erosion hazard. Clarks Hill is exempt from the MS4 requirements. The zoning ordinance only permits the storage of hazardous materials in certain zones by grant of a special exception from the Area Board of Zoning Appeals.

The Wabash River Enhancement Corporation continues to develop the Wabash River Watershed Management Plan. This plan aims to reduce sediment and pathogen levels, improve stream habitat, and reduce the spread of invasive species.

Emergency Services

FEMA defines emergency services as measures that protect people during and after a hazard. Tippecanoe County has a county-wide outdoor warning system, but could benefit from additional sirens in certain areas. The TEMA office monitors weather systems in cooperation with IDHS using the National Weather Service and has additional subscriptions for weather monitoring services. The county has mutual aid agreements regarding weather monitoring services with all local jurisdictions as well as District 4, which includes all adjoining counties and Cass County.

There is also a state-wide agreement that allows the distribution of resources throughout the entire state during disasters. The county utilizes storm spotters during threatening weather. Local county officials and some area residents monitor water level changes on important streams using USGS gauge stations and field observations; water levels are monitored vigilantly in order to prepare for flood conditions. Local television and radio stations also carry weather warnings and advisories. The Red Cross has existing agreements to use area schools and churches as shelters during emergencies.

Community Organization Active in Disaster

Tippecanoe County is part of a nine county Community Organization Active in Disaster, (COAD). COADs help build capacity to respond to disasters by increasing social capacity. Tippecanoe County is part of the West Central Indiana COAD, (WCI COAD). The WCI COAD is a network of agencies and organizations, who prepare for, respond to and help recovery from disasters. While the WCI COAD is just a network, and needs growth, it helps Tippecanoe County be better prepared for disaster. The WCI has been active since 2013.

Structural Control Projects

Participating communities have stormwater detention and/or retention sizing requirements for new developments. Tippecanoe County also resizes culverts and bridges as resources allow.

FEMA defines structural control projects as physical measures used to prevent hazards from reaching a property.

Public Information

There are several education and training programs throughout the county. MS4 communities, TEMA, SWCD, fire and/or police agencies and programs all have public information and education components. While some programs address hazards and methods of response, other programs focus on water-quality issues.

> FEMA defines public information activities as those that advise property owners, potential property owners, and visitors about the hazards, as well as ways to protect themselves and their properties from hazards.

Tippecanoe County's existing governmental structure ensures strong communication between various governmental agencies; this includes mutual aid agreements within the county and with surrounding counties, training for those interested in participating in emergency response and compatible GIS services for the many emergency response agencies. The existing zoning ordinance includes regulations that require safe rooms in mobile home parks (though no new mobile home parks have been developed since the ordinance took effect), restricts areas in which hazardous chemicals can be stored and prohibits development in the floodplain. The stormwater ordinance provides further protection to the floodplain by requiring compensatory storage for projects that include the addition of fill dirt to raise land above the regulatory flood elevation. Although the county's existing mitigation measures have many strong points, there are areas that can be improved. The on-line survey portion of this plan demonstrated that some area residents think access to fresh water, backup utilities and reliable communications would be most beneficial to the community. Additionally, a well-organized warning system for the upstream dams is a continued need to those residents living along the Tippecanoe River. Both the text of chapter five and its accompanying table are a comprehensive look at which mitigation measures could be improved and/or implemented by the county.

5.0 MITIGATION GOALS AND PROJECTS

This section identifies the mitigation goals and projects identified and evaluated by the HMP Planning Committee for participating jurisdictions.

Section 5.1 lists the mitigation categories, projects, local status, local priority, benefit-cost ratio, project location, responsible entity, funding source, and hazard addressed as identified by the HMP Planning Committee. The local status is categorized as "ongoing" and "proposed" and projects identified as such are expected to be completed within the 5-year term of this HMP.

Depending on the availability of funding, some proposed mitigation projects may take longer to implement. The proposed projects have been organized in terms of the six mitigation goals (detailed description can be found in **Section 5.2**) used by FEMA: prevention, property protection, natural resource protection, emergency services, structural control projects, and public information.

Chapter 6 of this plan includes a discussion of completed projects.

The development and this update of the HMP is a necessary step in the continuing implementation of programs, policies, and projects to mitigate the effects of hazards in Tippecanoe County. This planning effort had multiple intents:

- Identify the hazards which threaten this community;
- Identify to what extent they affect Tippecanoe County; and
- Identify mitigation strategies or projects that can be undertaken to mitigate the effects of the identified hazards.

This HMP meets the requirements of DMA 2000 and eligibility requirements for the Hazard Mitigation Grant program (HMGP), Flood Mitigation assistance (FMA), Pre-Disaster Mitigation (PDM) Grant, the Community Ratings System (CRS) as well as other FEMA programs. However, additional detailed studies will need to be completed prior to applying for grants or programs.

5.1 MITIGATION GOALS

The Planning Committee re-evaluated existing mitigation plans, programs, and projects in terms of the six mitigation measures used by FEMA: prevention, property protection, natural resource protection, emergency services, structural control projects, and public information. The committee also discussed the State's mitigation goals, which correspond with FEMA's six mitigation measures. Following the discussion, the Planning Committee decided on the following HMP mitigation goals.

<u>Prevention</u>

- Manage the development of land and construction of buildings to reduce the impact of hazards on people and property; and
- Continue to prohibit construction of homes and other structures in known hazard areas, such as the floodplain.

<u>Property Protection</u>

- Prohibit building in known hazard areas such as the floodplain, steep slopes, brownfields, and areas with erodible soils;
- Regular inspections during construction to ensure that hazard protection standards are included in local code enforcement.

Natural Resource Protection

- Continue to preserve and maintain the function of existing natural resources to reduce the impact of hazards to people and property.

Emergency Services

- Improve the efficiency, timing and effectiveness of warning, response and recovery efforts before, during, and immediately after a hazard;
- Create an emergency warning system for residents living downstream from dams;
- Continue to train persons involved in emergency response in the National Incident Management System;
- Learn more about earthquake risks and cascading effects;
- Use new technology to help with hazard response and communication between different agencies; and
- Use new technology for early warning and hazard alerts.

Structural Control Projects

- Prohibit structural control projects and remove existing structures in the floodplain so that it can function as naturally as possible.

Public Information

- Educate and inform the public about the risks of hazards and ways for citizens to protect themselves and their property before, during, and after a disaster; and
- Use non-traditional or alternative communication networks during a disaster if traditional networks are inoperable.

5.2 MITIGATION PROJECTS

The Planning Committee reviewed FEMA's list of mitigation ideas for each hazard studied during this planning effort and identified which of those best meet the community's needs. All mitigation projects were evaluated according to selected social, technical, administrative, political, and legal criteria.

The following list includes the key consideration for each evaluation criteria:

- Social – mitigation projects will have community acceptance, they are compatible with present and future community values, and do not adversely affect or neglect any segment of the population;
- Technical – the mitigation projects will be technically feasible, reduce losses in the long-term, and will not create more problems than they solve;
- Administrative – the mitigation projects may require additional staff time, alternative sources of funding, and have some maintenance requirements;
- Political – the mitigation projects will have political and public support;
- Legal – the mitigation projects will be implemented through the laws, ordinances, and resolutions that are either in place or will be created to implement the goals of this plan.

Consistent with the last plan, a detailed economic and social analysis of each proposed project was beyond the scope and intent of this HMP planning effort. However, the Planning Committee reviewed the projects and their potential benefits and costs associated with each project. During the pre-application phase of any grant request, a detailed benefit-cost analysis will be required. The committee reviewed each mitigation project's cost-to-benefit ratio.

The following projects include on-going projects, items not completed from the previous plan and new projects submitted by the planning committee, categorized by the six mitigation measures used by FEMA. Specific details on location, status, responsible entity and funding source for each project are identified in the sidebar next to each project category. A discussion of mitigation projects that have been completed since the last plan can be found in Chapter 6.

5.2.1 PREVENTION

Mitigation projects for prevention include land use planning and zoning, special projects and studies, floodplain management, geographic information services, safe rooms and community shelters, community ratings system, safety procedures for hazardous materials, tree maintenance, and utilities.

Land Use Planning and Zoning

- Incorporate the update of the Hazard Mitigation Plan into the Comprehensive Plan for Tippecanoe County. The Comprehensive Plan is a powerful planning tool for mitigation because it defines how and where the community should grow. Goals and objectives identified in the Comprehensive Plan are the foundation for all development ordinances in the community.
- Continue restriction of activities in the floodplain; continue compensatory storage requirements and prohibition on construction.
- Encourage innovative planning tools and ideas such as updating The Park, Recreation and Open Space element of the adopted Comprehensive Plan, cluster development, the development of greenways, alternative pavement products and conservation easements to limit and/or modify development in known hazard areas.

STATUS
On-going
LOCAL PRIORITY
High
BENEFIT/COST RATIO
High
LOCATION
Tippecanoe County
and all NFIP Communities
RESPONSIBLE ENTITY
APC
FUNDING SOURCE
Existing Budget
HAZARDS ADDRESSED
Dam Failure
Flooding

Watershed-based Projects and Studies

- Conduct special projects and studies such as hydrology and hydraulic modeling and watershed management planning in known hazard areas to better understand conditions and identify solutions. Support, with continued staff participation, the Wabash River Enhancement Corp.'s (WREC) 319 Watershed Plan for the Region of the Great Bend of the Wabash River watershed.

STATUS
On-going

RESPONSIBLE ENTITY
APC, Surveyor, Purdue, City Engineering Departments

LOCAL PRIORITY
High

FUNDING SOURCE
Existing budgets & grants

BENEFIT/COST RATIO
High

HAZARDS ADDRESSED
Dam Failure
Flooding

LOCATION
Tippecanoe County

Floodplain Management

- Continue the prohibition on the construction of walled structures in the floodplain, current requirements for no adverse impact in the floodplain, and participation in the Indiana Association of Floodplain and Stormwater Managers.
- Participation in the Indiana Risk Map Program to enhance existing mitigation planning efforts.
- Continue to seek grants to buy out homes located in the floodplain to help reduce risk to life and property damage for residents.
- Encourage Clarks Hill and Otterbein to join the NFIP.
- Encourage Laurimee Township/Stockwell to conduct hydrology and hydraulic modeling of the mapped study area.
- Encourage the town of Buck Creek/Washington Township to seek OCRA or similar funding for construction of a storm sewer system.
- Implement fluvial erosion hazard corridors and bluff zones into the Tippecanoe County Drainage Ordinance to protect future development along highly erosive/meandering natural creeks, rivers, and streams.

STATUS
On-going

RESPONSIBLE ENTITY
APC, County Surveyor, Clarks Hill, Otterbein, all other towns

LOCAL PRIORITY
High

FUNDING SOURCE
Existing budgets and grants

BENEFIT/COST RATIO
High

HAZARDS ADDRESSED
Dam Failure, Flooding

LOCATION
Tippecanoe County and communities with floodplains and flooding

Geographic Information Services

- Incorporate local data into the HAZUS-MH database to replace the national data set so that model predictions will be more accurate and specific to Tippecanoe County. This will need to be done each time the HMP is updated.

STATUS
Proposed & on-going
LOCAL PRIORITY
Local use: High
HAZUS: Medium
BENEFIT/COST RATIO
High
LOCATION
Tippecanoe County

RESPONSIBLE ENTITY
APC, Lafayette, MITS
FUNDING SOURCE
Existing budgets & Grants
HAZARDS ADDRESSED
Dam Failure, Earthquake, Flooding, Utility Failure, Tornado & Windstorm, Hazardous Materials

Safe Rooms and Community Shelters

- Encourage safe rooms in private homes and apartment buildings/complexes as well as mobile home communities throughout the county and partner jurisdictions. The warning time associated with many hazards such as earthquake, tornado or windstorm is minimal.
- Tippecanoe County encourages the construction, development and identification of places of Safe Refuge in all new public facilities, which are generally centrally located and are occupied by many people. Safe rooms may also be required in multi-family structures without a safe location such as a basement. While a basement is better than no shelter, the National Weather Service encourages a safe room located within a basement to better protect individuals from structural collapse. Particular focus needs to be given to all educational facilities within Tippecanoe County for protective and hardening measures for places of safe refuge for storm related protection needs, for building occupants.
- Clearly mark the location of safe rooms and shelters for both building occupants and visitors.

STATUS
On-going
LOCAL PRIORITY
High
BENEFIT/COST RATIO
High
LOCATION
Public buildings, multi-family buildings, public parks

RESPONSIBLE ENTITY
APC, City Engineers, County Building Commissioner, TEMA-DHS
FUNDING SOURCE
Existing budgets
HAZARDS ADDRESSED
Dam Failure, Flooding, Earthquake, Hazardous Material, Severe Winter Storm, Tornado & Windstorm, Utility

Tree Maintenance

- Continue tree maintenance in road rights-of-way, utility corridors, and public property. Regular maintenance of trees improves the health and longevity of public trees as well as reduces the potential for dead or dying limbs from falling and injuring people, damaging property, and utility lines during a tornado, windstorm, or severe winter storm.

STATUS
On-going

LOCAL PRIORITY
Low

BENEFIT/COST RATIO
High

LOCATION
All public property, ROW and utility corridors in the county

RESPONSIBLE ENTITY
Tipmont, Duke, Lafayette and West Lafayette Street Departments, County Highway Parks Dept.

FUNDING SOURCE
Utility rate or existing budgets

HAZARDS ADDRESSED
Severe Winter Storm, Tornado & Windstorm, Utility Failure, Flooding

5.2.2 PROPERTY PROTECTION

Mitigation projects for property protection include techniques for protecting buildings as well as property insurance.

Building Protection

- Continue to prohibit the construction of all buildings and critical facilities, in known hazard areas. Access to and from medical care, police, fire, emergency operation centers, power substations, potable water, and wastewater treatment facilities must be maintained during, and following, a hazard event.

STATUS
On-Going

RESPONSIBLE ENTITY
APC, Tipp., TEMA- DHS, Co. Grant Coordinator

LOCAL PRIORITY
Prohibit Constr: High
Acquisition: Medium

FUNDING SOURCE
Existing budget, property owners, Grants (PDM, FMA, HMGP)

BENEFIT/COST RATIO
High

HAZARDS ADDRESSED
Dam Failure, Earthquake, Flooding, Hazardous Material, Severe Winter Storm, Tornado & Windstorm, Utility Failure

LOCATION
All residential & non-residential structures in the floodplain and regulatory floodway

- Actively pursue buyout money for properties located in the floodplain. This money could be used for acquisition and relocation and would help reduce the high costs of response and recovery associated with flood events.

Property Insurance

- Continue encouragement to property owners in known hazard areas to purchase property and Hazard insurance (such as flood insurance) to protect their investment. Although insurance should not be considered an alternative to mitigating damages for any type of hazard, it does protect property owners from financial devastation if damage does occur.

STATUS
On-going

RESPONSIBLE ENTITY
APC, City Engineers

LOCAL PRIORITY
High

FUNDING SOURCE
Existing budget, property owners

BENEFIT/COST RATIO
High

HAZARDS ADDRESSED
Flooding, Dam Failure, Earthquake, Hazardous Material, Severe Winter Storm, Utility Failure, Tornado & Windstorm

LOCATION
All bldgs. in known Hazard areas

Building Codes

- Review construction standards and building codes to ensure that hazard protection standards, especially for critical facilities and structures (such as mobile homes) which are anchored by "tie downs", are incorporated into local building codes and inspections and to ensure that those codes are sufficient. Continue enforcement of adopted building codes in all jurisdictions. Building codes are an important mitigation measure for flooding, earthquake, tornado, windstorm, and severe winter storms. This may include sprinkler systems, structural bracing, anchor bolts, and secured exterior materials such as roofing shingles and shutters.

STATUS
On-going
LOCAL PRIORITY
High
BENEFIT/COST RATIO
High
LOCATION
All buildings in the county, especially those in known hazard areas

RESPONSIBLE ENTITY
APC, City Engineering
FUNDING SOURCE
Existing budget
HAZARDS ADDRESSED
Flooding, Dam Failure, Utility Failure, Earthquake Tornado & Windstorm, Hazardous Material, Severe Winter Storm

5.2.3 NATURAL RESOURCE PROTECTION

Mitigation projects for natural resource protection include land use planning and stormwater management.

Natural Resource Planning

- Continue to restrict development in the floodplain and encourage "No-Adverse Impact" (NAI) techniques, promoted by the Association of State Floodplain Managers (ASFPM).
- Protect natural wetlands from encroaching development and agricultural activities. Wetlands serve as natural collection basins for floodwaters. Acting like sponges, wetlands collect water, filter it, and release it slowly into rivers and streams. Protecting and preserving wetlands can help prevent flooding.

STATUS
On-going

LOCAL PRIORITY
Floodplain: HIGH
Wetland: MEDIUM
Stormwater: HIGH
BENEFIT/COST RATIO
High
LOCATION
All communities

RESPONSIBLE ENTITY
APC, City Engineers, TEMA-DHS
MS4 coordinator
FUNDING SOURCE
Existing budget
HAZARDS ADDRESSED
Flooding

- Continue to participate in, adopt and follow Well Head Protection guidelines set forth by Local State and Federal regulatory committees and commissions

Stormwater Management

- Continue to encourage Best Management Practices (BMPs) as identified in the Stormwater Quality Management Program (SWQMP) that address construction and post-construction site stormwater runoff control.

STATUS
On-going

LOCAL PRIORITY
High

BENEFIT/COST RATIO
High

LOCATION
All NFIP Communities

RESPONSIBLE ENTITY
City Engineers, Purdue, and County Surveyor

FUNDING SOURCE
Existing budget

HAZARDS ADDRESSED
Flooding

- Implement fluvial erosion hazard corridors and bluff zones into the Tippecanoe County Drainage Ordinance to protect future development along highly erosive/meandering natural creeks, rivers, and streams.

5.2.4 EMERGENCY SERVICES

Mitigation projects for emergency services include mutual aid agreements, emergency warning systems, and power back-up systems.

Mutual Aid Agreements

- Annually review, maintain and continue to utilize the mutual aid agreements between neighboring communities and counties to ensure a quick response to an incident or in the event of a hazard. Mutual aid agreements can be expanded to include utility and communication

STATUS
On-going

LOCAL PRIORITY
High

BENEFIT/COST RATIO
High

LOCATION
TEMA and all police and Fire departments in Tippecanoe County

RESPONSIBLE ENTITY
TEMA-DHS and County Chief's/Fire Assoc. D4 DPC, & D4 HCC Cross

FUNDING SOURCE
Existing budgets

HAZARDS ADDRESSED
Flooding, Dam Failure, Earthquake, Hazardous Materials, Severe Winter Storm

services in addition to fire protection. Tippecanoe County participates in the state-wide mutual aid agreement. Encourage development of a mutual aid agreement between all law enforcement departments/ agencies within the county and those in neighboring jurisdictions.

Emergency Warning Systems

- Utilize All Hazards outdoor warning systems and extend their coverage as populations expand to alert the residents of a potential tornado, severe weather event or other hazard. Advance warnings such as sirens, in conjunction with Emergency Alert System broadcasts, are an effective mitigation measure to reduce loss of life and property. It is important to note that warning sirens are only designed to alert those out of doors of a potential hazard. The general public should continue to be encouraged to have multiple warning devices and avenues of obtaining information.

STATUS
On-going & proposed

LOCAL PRIORITY
Sirens, Dams, NOAA Radio, Communication: HIGH
Stream Gauges, USO Amendment: MEDIUM

BENEFIT/COST RATIO
High

RESPONSIBLE ENTITY
TEMA-DHS, Local Governments, IDNR, USGS

FUNDING SOURCE
Existing budgets & Grants

HAZARDS ADDRESSED
All

LOCATIONS
Outdoor Warning Sirens needed in several areas of Tippecanoe County which include areas with high population and locations where large community gatherings. All critical facilities and new development in Tippecanoe County; All emergency response facilities.
Additional stream gauges are needed through out the county to continue to maintain flooding data.

- Utilize stream gauges as well as the USGS website for flood warning. NOAA Weather Radio and the EAS broadcast can be incorporated into the community's flood warning system.
- Ongoing cooperation with dam operators and owners with early warning systems for dam facilities and excessive water release. Continue partnerships with dam operators and early warning systems.
- Encourage purchase of NOAA weather radios to all critical facilities and train personnel on use of radio. Encourage residents and businesses to stay aware of current weather conditions with NOAA Weather Radios.

- Maintain a redundancy of communication systems to ensure clear communication with emergency personnel before, during, and after a hazard.
- Work with the development community to install all hazards warning sirens where they are currently not accessible.

Power Back-Up Generators

- Encourage emergency back-up generators at all critical facilities throughout the county because back-up power is vital; traffic signals should be included as facilities that need back-up power.

STATUS
Proposed
LOCAL PRIORITY
Critical Facilities: HIGH
Traffic Signals: MEDIUM
BENEFIT/COST RATIO
High
LOCATION
All critical facilities, major Intersections

RESPONSIBLE ENTITY
Property owner, TEMA-DHS, Parks & Street Dept.
FUNDING SOURCE
Construction and operating costs for building owners
HAZARDS ADDRESSED
Dam Failure Earthquake Flooding, Hazardous Materials, Severe Winter Storm, Tornado & Windstorm,

Hazard Database

- Collect and report accurate and community specific information on hazard events, including extent, magnitude, and costs to each community. Keeping a detailed, up-to-date, and consistent record of hazards in a central location will help keep the future planning process efficient and relevant.

STATUS
Proposed
LOCAL PRIORITY
Medium
BENEFIT/COST RATIO
High
LOCATION
County-wide documentation of hazard impacts for grants and updating this plan

RESPONSIBLE ENTITY
APC, TEMA-DHS
FUNDING SOURCE
Existing budget, Grants
HAZARDS ADDRESSED
ALL

5.2.5 STRUCTURAL CONTROL PROJECTS

Mitigation projects for structural control projects include requirements for high hazard dams and drainage systems.

Stormwater Drainage Improvements

- Installing, re-routing, or increasing the capacity of a storm drainage system that can involve detention and retention ponds, or drainage easements along streams and creeks could improve flood mitigation.
- Continued maintenance of waterways traversing through public lands to prevent localized flooding by removing debris such as large log jams. The risk of flooding increases when drainage systems are not properly maintained.
- Create regional detention solutions for appropriate waterways; typically, county-regulated drains in urban areas.
- Conduct watershed hydrology and hydraulic studies in areas with existing drainage issues in order to verify that the stormwater ordinance release rates are adequately strict to prevent future development from exacerbating these issues.

STATUS
Proposed
LOCAL PRIORITY
Medium
BENEFIT/COST RATIO
High
LOCATION
All new developments required to comply with stormwater ordinance.

RESPONSIBLE ENTITY
County Surveyor, City Engineering, Purdue
FUNDING SOURCE
Existing budgets, grants
HAZARDS ADDRESSED
Flooding

5.2.6 PUBLIC INFORMATION

Mitigation projects for public information include education and outreach projects.

Public Education and Outreach Projects

- Participate in community events, such as local neighborhood meetings, large planned events, and area school activities, throughout the year to share information on the different types of hazards, methods to minimize damages resulting from hazardous conditions, locations of safe shelters and how to respond when threatened by a hazard.

STATUS
On-going
LOCAL PRIORITY
High
BENEFIT/COST RATIO
High
LOCATION
Schools, community events, Public buildings, MS4 communities
RESPONSIBILE ENTITIY
TEMA-DHS, LEPC, Police and Fire, and Parks Depts.
FUNDING SOURCE
Existing budgets & grants
HAZARDS ADDRESSED
All

- Maintain literature regarding hazards in public facilities, such as libraries, government office buildings, police and fire stations as well as on government websites. FEMA publishes information on different aspects of hazards, including methods to prevent damage and response techniques.
- Continue to update literature and online resources for hazards or events specific to Tippecanoe County that are not covered by existing FEMA publications or where local regulations differ from national ones (for instance, floodplain management and logjam removal).
- Implement the Best Management Practices (BMP) identified in the county stormwater ordinance that addresses public education, outreach, participation, and involvement.

6.0 UPDATES AND MAINTENANCE PROCEDURES

This section of the plan describes how Tippecanoe County officials and offices will ensure that the plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and a revision every five years. This section describes how jurisdictions will incorporate the mitigation strategies and goals outlined in this plan into existing planning mechanisms and procedures.

Many of the mitigation projects and goals include on-going and continued efforts to reduce run-off, prohibit development in the flood plain and encourage innovating planning tools such as "green" development, riparian buffers and pervious paving materials, increasing protective measures and equipment to combat both physical and cyber threats to critical facilities and infrastructure. The following outlines updates and measurable progression. The Planning Committee has reviewed the Mitigation Projects & Goals and heard reports from responsible parties. The following is a list of Tippecanoe County's hazard mitigation accomplishments.

<u>Area Plan Commission</u>
Completed

- Acquire additional flood prone properties; 6 properties have utilized buy-out grant money since 2006;
- The county's GIS coordinator has added data to more effectively model hazards in the HAZUS program;
- Digital zoning maps were adopted;

Maintenance

- Continue to minimize development in the flood plain;
- Add additional protections to the flood plain by protecting the 500-year flood plain from development;
- Work with different organizations to develop riparian buffers around established waterways;
- Continue to incorporate updated flood maps in zoning ordinance.

<u>County Surveyor</u>
Completed

- The County's Comprehensive Stormwater Management Ordinance has been updated and approved by the County Commissioners (Ordinance 2017-04-CM);
- Digital Flood Insurance Rate Maps have been adopted;
- Completed a hydrologic study of the Indian Creek watershed and compiled recommendations for future public improvements;

Maintenance

- Continues to encourage buy-out grants;
- Encourages Clarks Hill to join the NFIP. The Office of Community and Rural Affairs (OCRA) has grant money to study and enhance drainage infrastructure in rural communities that experience overland flooding;
- Implement fluvial erosion hazard corridors and bluff zones into the Tippecanoe County Drainage Ordinance to protect future development along highly erosive/meandering natural creeks, rivers, and streams.

<u>TEMA-DHS</u>

Completed

- The county has three primary communication systems that operate independently to maintain redundancy. The traditional VHF System a County owned and operated 800mhtz system and a State owned and maintain 800mhtz system;
- A mutual aid agreement is in place and maintained between neighboring communities to ensure quick response in the event of an emergency;

Maintenance

- Outdoor warning systems are continually updated, tested and maintained. TEMA is looking into expanding coverage and investigating other ways of notifying the public of an emergency. There are 78 total sirens in the county;
- TEMA-DHS works regularly in response planning and exercise with Carroll and White Counties, including the Hydro Dam operators and emergency planners of NIPSCO who own and operate the 2 dams upstream on the Tippecanoe River as well as the Army Corps of for all of the Reservoirs upstream on the Wabash River;
- One of TEMA's strategic goals is to encourage the public to stay informed of severe weather and hazardous events and strongly encourages citizens to have more than one method to receive emergency notifications;
- TEMA's Emergency Operations Center is undergoing continual capability expansion and updating to improve communications and accommodate the needs of emergency personnel following a disaster;

- TEMA-DHS continues to work with all units of government and operators of critical facilities and infrastructure to ensure back-up generators are in place and planned for at new construction sites;
- Applying for grant money to revitalize the CERT training program and integration into the current TEMA-DHS volunteer training program to ensure viability of vetted and trained response personnel to assist in a disaster;
- TEAM-DHS partners with all other Public Safety Agencies in the development of Event Action Plans for all large publicly attended community events. One of the primary roles TEMA-DHS fulfills is that of active weather monitoring and notification to event command/management staff of potential incoming weather impacts;
- Improvements to government facilities to boost resiliency to either stop or overcome things like vehicle incursion into a building. Example: Construct Additional Pylons/Vehicle Incursion Resistance;
- Acquire response equipment or training for personnel which would respond to such an incident including training for what to do for those who work daily in public facilities. Example: Event Response Train/ Bomb Threat; Active Shooter; Gas Leak Drill; Fire Drill; Tornado Drill; Informacast;

Tippecanoe Government Commissioners/Information and Technology

Need	Cause Type	Proposed Options	Additional Details
Facility Entrance Detection & Screening	Human-Caused	Monitoring Screening & Detection equipment to prevent weapons, chemical agents pathogens or explosives from being brought into a facility.	update Walk-through Metal detectors; Chemical Sniffer; Building stationed K-9 units
Surveillance & Situation	Human-Caused	Surveillance equipment such as adding more cameras, panic alarms, automated security doors etc., to government facilities.	additional licensing; 300 cameras; additional switching, storage hardware & drives; additional alarm devices, IP speakers for common areas; advertising campaigns
Interdiction & Disruption	Human-Caused	Interdiction and Disruption Equipment and Training for Response personnel.	Additional Electronic locks & fob entry
IDS/IPS	Technological	Cyber Attacks or Ransomware detection and prevention equipment software & programs.	Planning for FireEye replacement / subscription; Creation and Funding for Security Position

Cyber-Forensics	Technological	Cyber Forensic Equipment, software and training of personnel who deal with tracking down those who initiate such attacks.	Creation and Funding for Security Position; external audits
Public Education & Outreach	Technological	Public Education and Outreach training on such events to include training of employees.	Know Be 4;
Emergency Generators	Technological	Addition of or replacement of emergency backup generators for critical facilities.	New Batteries for Server room UPS; Additional / Replace network closet UPSs
Solar Power	Technological	Upgrading or construction of Solar equipment for everyday use and use in protection of critical assets during times of power outages.	Fixed location solar (grid tied inverter, pure sinewave); Portable solar power for approximately 10 laptops (non-grid tied inverter, pure sinewave)
Technology Risk Assessment & Mitigation	Technological	External auditing of network & infrastructure vulnerabilities	Assessments and mitigation every 2 years
Networking Security	Technological		Barracuda Replacement; Firewall Replacement; Smartnet
Technology Infrastructure Security	Technological		AD Audit Subscription; Air gapped Backup vault;

6.1 ONGOING PLAN MAINTENANCE

The Area Plan Commission staff and the Executive Director of TEMA will reconvene the HMP Planning Committee annually during the five year planning cycle of this document. In preparation for the annual meeting, the appropriate APC staff member and TEMA's Executive Director will meet to review the mitigation strategies and to prepare a list of items accomplished as well as those that are in progress or have yet to be started. These individuals will then prepare a report of upcoming work items to present to the Planning Committee. At each annual meeting, the Committee will monitor, evaluate, and update the Plan as needed. Members of the Committee can meet to discuss the Plan between meetings when necessary. The meetings will be advertised

6.2 GOALS MAINTENANCE AND IMPLEMENTATION

The mitigation process table, the hazard database and changes to local ordinances as well as public input will help the Committee evaluate the plan in terms of its effectiveness. At

the annual meetings, the Committee may determine the plan needs to be changed or updated to increase effectiveness. APC staff will make all changes and updates to the plan. Prior to submitting the plan to the IDHS and FEMA, members of the planning committee will review the final document. At the end of the five-year period, the updated plan will be resubmitted to the state and federal agencies by APC staff.

6.2.1 HAZARD DATABASE

A goal of the initial plan was to create a hazard database that was updated as needed so that new information regarding disaster events can easily be added to the plan update. The database will enable the committee (as well as individual communities) to keep track of financial losses resulting from several events to assist future planning. This database will be monitored and maintained by both the APC and TEMA offices, with APC staff making the updates. This will continue to be a goal.

6.2.2 MITIGATION PROCESS TABLE

Outlined in the first plan was a goal for a mitigation process table to be created and maintained so that the information needed to update the plan will be readily available. This would allow the Committee to keep track of the status of each project and assist in providing direction for future initiatives. The table will be created after this plan's update that will keep track of the mitigation process and opportunities for mitigation projects. Available funding and a record for each project will be kept accordingly.

6.2.3 ZONING ORDINANCE UPDATES

Zoning ordinance updates benefiting all six member jurisdictions will also be added as needed and records of the changes will be kept by APC staff.

This is the second update of the HMP prepared by Tippecanoe County and NFIP communities; data used was the best information readily available during the planning process. There could be limitations based on current data and updates with new, more accurate data is expected and planned for. During the annual committee meetings, updates to the risk assessment and vulnerability analysis will be made as appropriate based on newer data.

6.3 INCORPORATION INTO EXISTING PLANS

Several of the proposed mitigation projects are currently on-going but are in need of enhancements. Existing planning documents adopted by the jurisdictions represented in this plan will be amended to reflect necessary changes.

GIS data needed for hazard analysis, including data needed for HAZUS-MH, will be updated throughout the five-year planning cycle by the County GIS Department as time allows.

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State Resources

All Agency, Indiana Drainage Handbook: http://www.in.gov/dnr/water/4893.htm

DNR, NFIP and Floodplain management resources: floodmaps.in.gov

DNR, lake and river construction regulations: http://www.in.gov/dnr/water/4963.htm

DNR authority under the Flood Control Act is further described: 312 IAC 10: Floodplain Management

DNR, LARE resource: “LARE Project Reports.” http://www.in.gov/dnr/fishwild/3303.htm

DNR, SHAARD: “SHAARD Database.” http://www.in.gov/dnr/historic/4505.htm

DNR, State historical county survey: http://www.in.gov/dnr/historic/2824.htm

DNR, Invasive Species, Gypsy Moth and EAB: http://www.in.gov/dnr/3123.htm to report, call: (317) 232-412

Evaluating Earthquake Losses due to Ground Failure and Identifying their Relative Contribution can be accessed through the following link: http://www.iitk.ac.in/nicee/wcee/article/13_3156.pdf.

IDEM, State Rule 5, Land Management:
http://www.in.gov/idem/permits/water/wastewater/wetwthr/storm/rule5.html

IDEM, Meth Cleanup Information: http://www.in.gov/idem/health/2385.htm

IDNR, Water Shortage Plan: https://www.in.gov/dnr/water/files/watshplan.pdf

Indiana State Police, Meth Resources: https://socratadata.iot.in.gov/Government/ISP-Meth-Lab-Locations-Map/ktyc-iiu7

Indiana State Department of Health, HIV Outbreak: http://www.in.gov/isdh/files/2015_County_Profiles.pdf

INDOT, Traffic Wise, Real-time traffic Conditions: http://pws.trafficwise.org/pws/

INDOT, Preservation Initiative: http://www.in.gov/indot/3371.htm

Purdue, Invasive Species, EAB Resources: https://extension.entm.purdue.edu/EAB/

Additional Resources

EPA, Local Emergency Planning Committees: https://www.epa.gov/epcra/energize-your-local-emergency-planning-committees-lepc

EPA, Excessive Heat Events Guidebook: https://www.epa.gov/heat-islands/excessive-heat-events-guidebook

ESRI Map:
https://www.arcgis.com/apps/PublicInformation/index.html?appid=4ae7c683b9574856a3d3b7f75162b3f4

Extreme Heat: https://www3.epa.gov/climatechange/pdfs/print_heat-deaths-2014.pdf

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FEMA Training Guide: https://training.fema.gov/emiweb/is/is393a/is393.a-lesson4.pdf

FEMA, Commuter Emergency Plans: http://www.fema.gov/media-library/assets/documents/90370

FEMA, Safe Room Guidance: https://www.fema.gov/media-library/assets/documents/3140

FEMA, Local Mitigation Planning Handbook: https://www.fema.gov/media-library/assets/documents/31598

US Fish and Wildlife, endangered and threatened species:
https://www.fws.gov/midwest/endangered/saving/outreach.html

US Fish and Wildlife, Bat Children Resources:
https://www.fws.gov/midwest/endangered/mammals/inba/curriculum/InbaKidsCavesOhMy.pdf

USGS, FIM maps: http://water.usgs.gov/osw/flood_inundation/

USGS, NHD Data: https://nhd.usgs.gov/data.html

US Fish and Wildlife, Endangered and Threatened Species:
https://www.fws.gov/midwest/endangered/saving/outreach.html

Tornado Buffers: http://www.spc.noaa.gov/faq/tornado/ef-scale.html

APPENDIX A—NOTES AND AGENDAS FROM MEETING

Public meeting #1

COMMUNITY PARTNERS AGENDA

Tippecanoe County MHMP 2021 Monday, December 7, 2021 8:00 am
TCOB, Tippecanoe Room, 20 North 3rd Street, Lafayette, IN

SIGN Attendance Sheet

Call the meeting to order

Approve meeting minutes from previous meeting.

Introduce new TEMA Coordinator

APC explain General Background – Flood mitigation and natural hazardous

OVERALL purpose of this documentation

Hazard Classification Explanation

Mitigation GOALS for Tippecanoe Community Partners

Short/Long term recovery and how it impacts Mitigation and Community Resiliency

Return to TEMA Advisory Board meeting:

Events & Activities and spending report.

Other Business

Adjourn

MHMP Public Meeting Sign-In Sheet

Project:	2021 Tippecanoe County MHMP Review	**Meeting Date:**	12/7/2021
Facilitator:	TEMA Advisory Board	**Place/Room:**	Tippecanoe Room

Name	Signature	E-Mail
Barry Smith	SMITHOPES@aol.com	
Jeff Butz		Jeffrey.Butz@Evonik.com
Perry Martin	Perry Martin	
Brian Phillips		Lafayette P.D.
Art Chacate		West Lafayette PD
Jason Philhower		jhphilhower@westlafayette.in.gov
Joe Cecil		dcordell@Tippecanoe.In.Gov
Shawn Sherry	Shawn Sherry	ssherry@tippecanoe.in.gov
Shanet Anderson		wrandeson@tippecanoe.in.gov
Carol Sneby		Csneby@purdue.edu
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Marcia R. Mills	TEMA	mmills@TIPPECANOE.IN.GOV
Kent Krofft		KKROFFT@TIPPECANOE.IN.GOV
Larry Autenrieth		lautenrieth@tippecanoe.in.gov

ONLINE ATTENDANCE: Robert Goldsmith - rgoldsmith@tippecanoe.in.gov
Zach Beasley - zbeasley@tippecanoe.in.gov
Ryan O'Bara - robara@tippecanoe.in.gov
David Hittle - dhittle@tippecanoe.in.gov
Aria Staiger - astaiger@tippecanoe.in.gov
Town of Shadeland - Tim Balensiefer -

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NOTICE of Public Hearing

The Multi-Hazard Mitigation Planning Committee of Tippecanoe County will host a public information and strategy planning session on Tuesday, December 7th, 2021 at 8 AM in the Tippecanoe County office Building, Tippecanoe Room, 20 North 3rd Street, Lafayette, IN.

Over the last several months, a planning committee, consisting of community members, has worked with the Polis Center at Indiana University-Purdue University Indianapolis (IUPUI) to update the county Multi-Hazard Mitigation Plan. Once the plan is updated, the committee will submit it to FEMA for approval. The planning committee is interested in receiving public input on the plan. Anyone that would like to provide input or has any questions should contact Tippecanoe County EMA by phone :765-742-1334 or by email: T EMA@tippecanoe.in.gov This meeting will also be hosted virtually to "GoToMeeting" please contact the EMA office for connection information.

LAF - 12/1/2021 5025476 hspaxlp

Public Hearing Notice and Advertisement

Public meeting #2

COMMUNITY PARTNERS AGENDA

Tippecanoe County MHMP 2021 Monday, February 28, 2022 11:30 am
TCOB, Tippecanoe Room, 20 North 3rd Street, Lafayette, IN

General Background – Flood mitigation and natural hazardous	Larry	5 min
OVERALL purpose of this documentation	Marty	5 min
Explain purpose of each representative on Committee Identify if those invited are correct contacts	Sharon	5 min
Hazard Classification Explanation	Marty	5 min
Mitigation GOALS for Tippecanoe Community Partners Example of what we are looking from each department – broad to specific	Marty	20 min
LSA – logistical staging area – for municipalities and citizens	Marty	10 min
Short/Long term recovery and how it impacts Mitigation and Community Resiliency		
Explain approval process and what is next.	Larry	5 min

Community Committee MHMP 2021

NAME	Representing	SIGNATURE
William Anderson	Tippecanoe EMA	
Larry Aukerman	Tippecanoe County APC	
Tim Balensiefer	Shadeland District	
Zach Beasley	Tippecanoe County Surveyor	
Glynis Boone	Evonik	
Tracy Brown	Board of Commissioners	
David Byers	Board of Commissioners	
Travis Catlin	Arconic	
Art Choate	WL Police Department	
Doug Cordell	Tippecanoe EMA	
Lukas Darling	Town of Ottebein	
Richard Doyle	City of Lafayette	
Randy Evans	Lafayette Fire	
Robert Goldsmith	Tippecanoe County Sheriff	
David Hittle	Tippecanoe County APC	
Whitney Hobbs	Tippecanoe County Health	
Jeff Houston	Tippecanoe County Health	
Sharon Hutchison	Tippecanoe Co Government	
Eric Johnson	Tippecanoe County LEPC	
Kent Kroft	Tippecanoe DoIT	
Kavita Kulkarni	Tippecanoe DoIT	
Stan Lambert	WREC	
Thomas P. Murtaugh	Board of Commissioners	

Community Committee MHMP 2021

NAME	Representing	SIGNATURE
Ron Noles	Tippecanoe County Health	
Ryan O'Gara	Tippecanoe County APC	
Terry Ruley	Tippecanoe County Sheriff	
Carol Shelby	Envirmnt H&S @ Purdue	
Mike Spencer	Highway Dept - Engineering	
Chad Spitznagle	City of West Lafayette	
Scott Taylor	Town of Dayton	
Martin Webb	Tippecanoe EMA	
Mike Wolf	Tippecanoe Co Bldg Comm	
ROB HAINJE	TCSO	

Public meeting #3

THE
AREA PLAN COMMISSION
OF TIPPECANOE COUNTY

NOTICE OF PUBLIC HEARING

DATE ..... JUNE 15, 2022
TIME ..... 6:00 P.M.
PLACE ..... COUNTY OFFICE BUILDING
20 NORTH 3RD STREET
LAFAYETTE, IN 47901

AGENDA

I. BRIEFING SESSION

II. APPROVAL OF MINUTES

III. NEW BUSINESS

IV. PUBLIC HEARING

A. ORDINANCE AMENDMENTS

UZO AMENDMENT #103-A:
This is the section of UZO Amendment #103 that was previously tabled, related to self-storage warehouse businesses within urbanized areas. It returns to the Area Plan Commission with amendments from the Lafayette City Council and the County Commissioners. *CONTINUED FROM THE MAY 18TH APC MEETING.*

B. COMPREHENSIVE PLAN AMENDMENTS

RESOLUTION #2022-03:
A resolution to adopt into the *Comprehensive Plan,* the updated draft of the County's Multi-Hazard Mitigation Plan as required by the Federal Disaster Mitigation Act of 2000.

C. SUBDIVISIONS

1. **S-5071 WIGGINS FARM SUBDIVISION (major-preliminary):**
Petitioner is requesting preliminary approval of a 78-lot, residential subdivision (with two outlots) on 29.61 acres located on the east side of N. Salisbury Street, ¼ mile north of Kalberer Road, in West Lafayette, Wabash 06 (NE) 23-4. *CONTINUED FROM THE MAY 18TH APC MEETING BECAUSE PUBLIC NOTICE WAS NOT DONE.*

LA | G:\APC\Agendas\2022 APC Agendas\06152022 APC agenda.docx | Printed: 6/16/2022 | Page: 1
In accordance with the requirements of Title II of the Americans with Disabilities Act of 1990 ("ADA"), the Area Plan Commission of Tippecanoe County will not discriminate against qualified individuals with disabilities on the basis of disability in its services, programs, or activities. For more information visit www.tippecanoe.in.gov/ada

MHMP Meeting Sign-In Sheet

Project:	Hazard Mitigation Plan Last Public Meeting	**Meeting Date:**	06/15/2022
Facilitator:	Sharon Hutchison	**Place/Room:**	Tippecanoe Room

Name	Signature	E-Mail
Thomas P. Murtaugh		tmurtaugh@tippecanoe.in.gov
Jody Hamilton		jhamilton@tippmont.org
TRACY BROWN		TABROWN@TIPPECANOE IN.GOV
Jerry Reynolds		MG54TF47@yahoo.com
GREG JONES		GREGJ.RIVERSIDE@GMAIL.com
Vicki Pearl		vpearl@secfedbank.com
Jackson W. Bogan		jwb@mitchellagy.com
Robert Metzger		bometz98@aol.com
Kathy Parker		kcfparker@gmail.com
PERRY E BROWN		perryebrown@msn.com
Jason Dombkowski		jdom49@hotmail.com
Lisa Dullum		ldullum@tippecanoe.in.gov
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LARRY T. Leverenz		llevere@me.com
ERIC H. BURNS		eburns@witherellaw.com

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MHMP Meeting Sign-In Sheet

Project:	Hazard Mitigation Plan Last Public Meeting	**Meeting Date:**	06/15/2022
Facilitator:	Sharon Hutchison	**Place/Room:**	Tippecanoe Room

Name	Signature	E-Mail
Bradley Neely		ban@rtslawfirm.com
Chad Spitzmiller		Cspitzmiller@wl.in.gov
Carla Stearns	Carla Stearns	happyc89@aol.com
Tim Balensiefer		timb@tbirddesign.com
Gail Michael	Gail Michael	gpmichael45@gmail.com
Dick Michael	Dick Michael	rmmichael44@gmail.com
BRENDAN BETZ		brenden.NTB@outlook.com
Lukas Darling		LDarling@otterbein.in.gov
Stephen Cleversey		STCleven@comcast.net
Leslie Berkheimer		Woodlaw1965@aol.com
Larry Ackerman		
David Hittle		
Ryan O'Gara		

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APPENDIX B—MEDIA

Reports for Public Input

Media Release

For Immediate Release
May 27, 2022

The Area Plan Commission of Tippecanoe County will present the draft 2022 Hazard Mitigation Plan at the on-line June 15 Area Plan Commission meeting. The meeting is open to the public and an opportunity for citizens to review, comment and ask questions about the plan.

https://www.facebook.com/TippecanoeCountyIndiana, or YouTube page: https://www.youtube.com/channel/UCJleeA9ZQo9EllGdZTdjurQ).

The Federal Disaster Mitigation Act of 2000 (DMA 2000) requires communities to prepare a Hazard Mitigation Plan, (MHMP) in order to be eligible for future mitigation funding through the Indiana Department of Homeland Security and the Federal Emergency Management Agency. The intent of the planning process is to prepare for a disaster before it occurs to reduce the physical, social and economic impact of that disaster. The disasters most likely to occur in this community were analyzed for severity, duration, warning time, extent and potential damage. These disasters include: hazardous materials, flooding, tornados/windstorm, severe winter storm, earthquake, dam failure and utility failure.

To ensure the future flow of money to our community, the Area Plan Commission, in cooperation with the Tippecanoe County Emergency Management Agency and on behalf of Tippecanoe County, Lafayette, West Lafayette, Battle Ground, Clarks Hill, Dayton, Otterbein and Shadeland has prepared a draft Hazard Mitigation Plan. The plan identifies ways to lessen the impact of disasters on our community and ways to reduce loss of life and property when a disaster does strike.

Local governments have some existing mitigation tools in place; the plan calls for the preservation or expansion of existing measures while adopting new initiatives. Examples of existing mitigation tools:

1. The Area Plan Commission and its member jurisdictions have prohibited construction in the floodplain since 1965; the Town of Shadeland also prohibits construction in the floodplain.
2. In 1998, the Unified Zoning Ordinance began requiring under-ground tornado shelters for new manufactured home communities. This concept could be expanded for places of public assembly, apartment complexes or manufacturing plants.
3. Use of NOAA weather radios at critical facilities, such as hospitals and by residents in known hazard areas, would reduce risk to citizens and property by providing additional time to seek shelter and secure belongings.

The Area Plan Commission is now inviting the public to comment on the draft version of the MHMP, which is available online at the Tippecanoe County Area Plan Commission website homepage at

www.tippecanoe.in.gov/apc

Public comment will be received from now until June 15, 2022 and can be mailed to the Area Plan Commission, 20 N. 3rd Street, Lafayette 47901 or emailed to Larry Aukerman at laukerman@tippecanoe.in.gov

Meeting details:
When: 6:00 pm, June 15, 2022
Where: In the Tippecanoe County office building at 20 N Third Street, in Lafayette
List or watch the presentation on Tippecanoe County's Facebook or YouTube web Page.

For addition information, contact:
Larry Aukerman
Area Plan Commission of Tippecanoe County
20 North 3rd Street
Lafayette, IN
(765) 423-9242
laukerman@tippecanoe.in.gov
---END----

APPENDIX C – ADDITIONAL DATA

Day	Month	Year	Event Type	Injuries (Direct)	Injuries (Indirect)	Deaths (Direct)	Deaths (Indirect)	Property Damage	Crop Damage	Tornado Scale	Episode Narrative	Event Narrative
24	February	2016	Winter Storm	0	0	0	0	NULL	0.00K	NULL	A strong area of low pressure, one that was responsible for a severe weather outbreak on February 23rd across parts of the Gulf Coast area, moved through the Ohio Valley on February 24th. This storm brought blizzard conditions to parts of northwest sections of central Indiana. Southeastern areas saw mainly rain with this event. Conditions changed rapidly in short distances across the northwest half of the area.||Strong forcing with this system brought moderate rain to parts of the area early in the morning of the 24th. The low brought gusty winds, with peak winds during the day of around 40 mph.||Cold air wrapped into northwest sections of central Indiana during the morning, changing the rain to snow. Strong forcing remained in place across northwest sections of the area during the day, keeping the snow across the same areas. This led to the higher snow amounts. Warmer air just to the southeast kept the precipitation as rain until mid afternoon, leading to lower snow amounts. The difference in temperatures between the snow and rain areas was just a few degrees.||Snow amounts ranged from a trace across eastern and southern sections of the area to around 6 inches across the extreme northwest portions. A tight gradient in snowfall amounts was seen in the northwest, where a band of heavy snow set up and lingered.	Snowfall observations of 5 to just over 7 inches fell within Tippecanoe County, with the heaviest falling over northwest portions of the county. No other impacts were reported.
31	March	2016	Tornado	0	0	0	0	50.00K	NULL	EF1	A line of thunderstorms, that stretched from Chicago to St. Louis during the early afternoon on March 31st, pushed eastward into northwest portions of central Indiana during the mid/late-afternoon hours. As this broken line of showers and storms moved across the state, a few reports of severe weather were received. One such report was of a tornado near the Lafayette area. Portions of the damage from this tornado was caught on a surveillance camera.	The National Weather Service in Indianapolis has confirmed an EF-1 tornado near Lafayette in Tippecanoe County on March 31, 2016. The EF-1, 30-yard wide tornado was captured on video as it moved across the lot at the Wabash National Trailer site. With win
2	April	2016	High Wind	0	0	0	0	NULL	NULL	NULL	A strong area of low pressure brought strong winds to central Indiana during April 2. Winds of over 60 mph were recorded in some areas, with many trees and power lines down throughout the area. In addition, cold air with the system brought up to an inch of snow to parts of the northern half of central Indiana.	A 62 mph high wind gust was measured at the Purdue University Airport.
22	June	2016	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	A warm front moved across central Indiana during the evening of June 22 and morning hours of June 23. Hot and humid air behind the front provided fuel for the storms. An upper level wave helped to generate the storms.||Thunderstorms developed across central Indiana as the warm front moved into the area. Some of the storms produced wind gusts of 80 to 100 mph along with heavy rain. The storms damaged structures and brought down many trees and power lines.	An estimated 60 mph thunderstorm wind gust was observed in this location.
22	June	2016	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	A warm front moved across central Indiana during the evening of June 22 and morning hours of June 23. Hot and humid air behind the front provided fuel for the storms. An upper level wave helped to generate the storms.||Thunderstorms developed across central Indiana as the warm front moved into the area. Some of the storms produced wind gusts of 80 to 100 mph along with heavy rain. The storms damaged structures and brought down many trees and power lines.	A 100 mph thunderstorm wind gust was measured in this location.
22	June	2016	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	A warm front moved across central Indiana during the evening of June 22 and morning hours of June 23. Hot and humid air behind the front provided fuel for the storms. An upper level wave helped to generate the storms.||Thunderstorms developed across central Indiana as the warm front moved into the area. Some of the storms produced wind gusts of 80 to 100 mph along with heavy rain. The storms damaged structures and brought down many trees and power lines.	An 87 mph thunderstorm wind gust was measured in this location.
23	June	2016	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	A warm front moved across central Indiana during the evening of June 22 and morning hours of June 23. Hot and humid air behind the front provided fuel for the storms. An upper level wave helped to generate the storms.||Thunderstorms developed across central Indiana as the warm front moved into the area. Some of the storms produced wind gusts of 80 to 100 mph along with heavy rain. The storms damaged structures and brought down many trees and power lines.	An estimated thunderstorm wind gust of 70 mph was observed in this location.
20	June	2016	Thunderstorm Wind	0	0	0	0	1.00K	NULL	NULL	A supercell thunderstorm moved across northwest portions of central Indiana during the evening of June 20th. Straight line wind damage was observed in a few locations.	A tree, approximately 35 feet tall and 5 feet wide, was downed in this location due to damaging thunderstorm wind gusts.
15	August	2016	Tornado	0	0	0	0	3.50K	2.00K	EF0	An area of low pressure moved north of central Indiana allowing the region to remain in tropical air. A single, long tracking supercell thunderstorm moved northeast through Hendricks, Boone, Hamilton, Tipton, and Howard counties,	An EF-0 tornado, with maximum winds estimated at 85 mph, downed

Day	Month	Year	Event Type	Injuries (Direct)	Injuries (Indirect)	Deaths (Direct)	Deaths (Indirect)	Property Damage	Crop Damage	Tornado Scale	Episode Narrative	Event Narrative
											the evening of August 15, producing six tornadoes. Two other thunderstorms produced separate tornadoes, one in Avon and one northwest of Lafayette.	three trees, destroyed a mailbox, and flattened a 25 yard wide path of corn.
18	November	2016	Thunderstorm Wind	0	0	0	0	1.50K	0.00K	NULL	A band of showers and thunderstorms moved into western Indiana from eastern Illinois during the middle to late afternoon hours of November 18th. Strong to damaging wind speeds and wind damage was observed, mainly across portions of the western half of central Indiana.	A tree and large limbs were downed due to damaging thunderstorm wind gusts.
30	March	2017	Hail	0	0	0	0	0.00K	0.00K	NULL	An area of low pressure brought thunderstorms to central Indiana during the afternoon and evening of March 30th, some of which produced large hail and damaging winds.	NULL
20	March	2017	Hail	0	0	0	0	0.00K	0.00K	NULL	Thunderstorms developed ahead of a low pressure system. Warm and unstable air moved above some cooler air at the surface and generated thunderstorms. The storms brought large hail to parts of central Indiana.	NULL
20	March	2017	Hail	0	0	0	0	NULL	0.00K	NULL	Thunderstorms developed ahead of a low pressure system. Warm and unstable air moved above some cooler air at the surface and generated thunderstorms. The storms brought large hail to parts of central Indiana.	NULL
10	April	2017	Hail	0	0	0	0	0.00K	0.00K	NULL	A cold front pushed into northwest portions of central Indiana during the evening of the April the 10th. Some showers and thunderstorms developed ahead of the front, producing a few hail reports, two of which were severe.	NULL
10	April	2017	Hail	0	0	0	0	NULL	NULL	NULL	A cold front pushed into northwest portions of central Indiana during the evening of the April the 10th. Some showers and thunderstorms developed ahead of the front, producing a few hail reports, two of which were severe.	NULL
10	April	2017	Hail	0	0	0	0	NULL	NULL	NULL	A cold front pushed into northwest portions of central Indiana during the evening of the April the 10th. Some showers and thunderstorms developed ahead of the front, producing a few hail reports, two of which were severe.	NULL
10	April	2017	Hail	0	0	0	0	NULL	NULL	NULL	A morning round of thunderstorms moved across central Indiana on April 10th, as a cold front advanced toward the area from the west. Hail, some as large as golf balls, fell on parts of the area. Heavy rain also fell at some locations.	NULL
10	April	2017	Hail	0	0	0	0	NULL	0.00K	NULL	A morning round of thunderstorms moved across central Indiana on April 10th, as a cold front advanced toward the area from the west. Hail, some as large as golf balls, fell on parts of the area. Heavy rain also fell at some locations.	NULL
10	April	2017	Hail	0	0	0	0	NULL	NULL	NULL	A morning round of thunderstorms moved across central Indiana on April 10th, as a cold front advanced toward the area from the west. Hail, some as large as golf balls, fell on parts of the area. Heavy rain also fell at some locations.	NULL
10	April	2017	Hail	0	0	0	0	NULL	NULL	NULL	A morning round of thunderstorms moved across central Indiana on April 10th, as a cold front advanced toward the area from the west. Hail, some as large as golf balls, fell on parts of the area. Heavy rain also fell at some locations.	NULL
6	May	2017	Flood	0	0	0	0	2.00K	1.00K	NULL	A front and an a low pressure system brought heavy rain to central Indiana for the second time in a week. Some areas received more than 2 inches of rain once again. This lead to road closures due to high water as well as new & prolonged flooding of area streams and rivers. Some water rescues were performed as well.	Indiana Department of Homeland Security reported seven people and a dog being rescued from where they were camping behind the city's waste water treatment plant. They became stranded by rising water near the 800 block of South River Road. Police received a call from one of the campers at about 7:45 AM EDT Saturday. Conservation officers had to launch an air boat through a field to get to them. No injuries were reported.
22	July	2017	Thunderstorm Wind	0	0	0	0	1.50K	NULL	NULL	A squall line dropped southeast into central Indiana from the northwest during the late evening of the 21st and early morning of the 22nd. A portion of the line bowed as it moved into the area producing damaging winds. Thunderstorms caused mainly wind damage across the northern half of central Indiana during this timeframe.	Some tree damage due to damaging thunderstorm wind gusts was noticed from Country Road 750 to 900 East between State Road 26 and Coutny Road 200 North.
22	July	2017	Thunderstorm Wind	0	0	0	0	15.00K	NULL	NULL	A squall line dropped southeast into central Indiana from the northwest during the late evening of the 21st and early morning of the 22nd. A portion of the line bowed as it moved into the area producing damaging winds. Thunderstorms caused mainly wind damage across the northern half of central Indiana during this timeframe.	Numerous trees were down in multiple portions of the county due to damaging thunderstorm wind gusts.
5	November	2017	Hail	0	0	0	0	NULL	NULL	NULL	Waves of low pressure moved along a strong cold front on November 5th, generating strong to severe thunderstorms during the afternoon and evening hours. Strong 850mb winds brought up plenty of moisture for the storms to work with and the storms produced some tornadoes, damaging winds, large hail, and flooding.	NULL
5	November	2017	Hail	0	0	0	0	NULL	NULL	NULL	Waves of low pressure moved along a strong cold front on November 5th, generating strong to severe thunderstorms during the afternoon and evening hours. Strong 850mb winds brought up plenty of moisture for the storms to work with and the storms produced some tornadoes, damaging winds, large hail, and flooding.	Winds in this location were estimated at 50 mph.
5	November	2017	Thunderstorm Wind	0	0	0	0	5.00K	0.00K	NULL	Waves of low pressure moved along a strong cold front on November 5th, generating strong to severe thunderstorms during the afternoon and evening hours. Strong 850mb winds brought up plenty of moisture for the storms to work with and the storms produced some tornadoes, damaging winds, large hail, and flooding.	Three electric poles have been blown down at or near the intersection of East County Line Road South and South County Road 1000 East due to

Day	Month	Year	Event Type	Injuries (Direct)	Injuries (Indirect)	Deaths (Direct)	Deaths (Indirect)	Property Damage	Crop Damage	Tornado Scale	Episode Narrative	Event Narrative
												damaging thunderstorm wind gusts. This necessitated a road closure.
18	November	2017	Thunderstorm Wind	0	0	0	0	3.00K	0.00K	NULL	A strong low pressure system moved across central Indiana, bringing warm and humid air up with it. Thunderstorms developed with the low and along/ahead of its associated cold front during the late morning through the afternoon of November 18th. A weak tornado was also noted. Outside of storms, winds gusted over 40 mph.	Trees were reported down near the intersection of County Roads 900 East and 200 South due to damaging thunderstorm wind gusts.
18	November	2017	Flood	0	0	0	0	5.00K	0.00K	NULL	A strong low pressure system moved across central Indiana, bringing warm and humid air up with it. Thunderstorms developed with the low and along/ahead of its associated cold front during the late morning through the afternoon of November 18th. A weak tornado was also noted. Outside of storms, winds gusted over 40 mph.	There were multiple reports of water ponding in yards across Lafayette due to heavy rainfall.
18	November	2017	Tornado	0	0	0	0	8.00K	0.00K	EF0	A strong low pressure system moved across central Indiana, bringing warm and humid air up with it. Thunderstorms developed with the low and along/ahead of its associated cold front during the late morning through the afternoon of November 18th. A weak tornado was also noted. Outside of storms, winds gusted over 40 mph.	This EF0 tornado touched down briefly northeast of Dayton and damaged a house and several trees. A few strips of siding was removed from the house and a few trees were downed as well.
3	April	2018	Tornado	0	0	0	0	25.00K	0.00K	EF0	A low pressure system generated numerous thunderstorms across central Indiana on April 3rd. The first few rounds of thunderstorms produced heavy rain and flooding across the area, while the final round of thunderstorms brought damaging winds and a couple of tornadoes.	This EF-0 tornado, with a max wind speed of 85 mph, affected one homestead and a thin band of trees. Damage at the homestead included barn skylights being blown out from wind entering an east-facing opening, debris from half an outbuilding`s roof and coll
1	April	2018	Heavy Snow	0	0	0	0	NULL	NULL	NULL	An area of low pressure brought snow to central Indiana late on April 1. Some areas received around 6 inches of snow. The 2.1 inches of snow at Indianapolis set a record for the date. The snow was also the most ever recorded on an Easter Sunday.	Reports of 6 to 6.8 inches of snow came in from the Lafayette and West Lafayette areas. No other impacts were reported.
3	April	2018	Thunderstorm Wind	0	0	0	0	7.00K	0.00K	NULL	A low pressure system generated numerous thunderstorms across central Indiana on April 3rd. The first few rounds of thunderstorms produced heavy rain and flooding across the area, while the final round of thunderstorms brought damaging winds and a couple of tornadoes.	Multiple mature trees were downed in downtown Lafayette due to damaging thunderstorm wind gusts.
3	April	2018	Thunderstorm Wind	0	0	0	0	0.10K	0.00K	NULL	A low pressure system generated numerous thunderstorms across central Indiana on April 3rd. The first few rounds of thunderstorms produced heavy rain and flooding across the area, while the final round of thunderstorms brought damaging winds and a couple of tornadoes.	High thunderstorm winds were observed in this location. Some tree limb debris was seen along with street signs blowing.
10	June	2018	Thunderstorm Wind	0	0	0	0	0.80K	NULL	NULL	A series of lines of showers and thunderstorms developed across central Illinois and moved southeast into central Indiana during much of the day into the evening on June 10th. The first line produced some damaging wind and small hail in the northeast. The next batch provided mainly thunderstorm wind gusts across west-central and central Indiana. After that, large hail was reported in Knox County during the late afternoon, with flash flooding reported during the evening hours.	Several large limbs of unknown size had broken off of a healthy tree due to damaging thunderstorm wind gusts. This report was relayed via social media.
7	June	2018	Thunderstorm Wind	0	0	0	0	1.50K	0.00K	NULL	A band of scattered showers and thunderstorms developed over the northern reaches of central Indiana during the afternoon of June 7th. As these storms pushed eastward and southeastward, a few isolated severe and sub-severe reports were received during the evening hours.	A couple smaller trees were downed and a small outbuilding was destroyed on County Road 350 North due to damaging thunderstorm wind gusts.
8	June	2018	Hail	0	0	0	0	NULL	NULL	NULL	Scattered thunderstorms developed near a nearly stationary front across central Indiana. Some storms produced pea to nickel size hail, but one storm produced hail around the size of golf balls.	NULL
6	August	2018	Thunderstorm Wind	0	0	0	0	3.00K	NULL	NULL	A line of scattered showers and thunderstorms moved southeast across the northern half of central Indiana during the late evening of August 6th and early morning of August the 7th. A few of the stronger storms produced damaging thunderstorm wind gusts.	A privacy fence was blown over and a large garden shed was destroyed due to damaging thunderstorm wind gusts. This report was relayed by broadcast media.
6	October	2018	Thunderstorm Wind	0	0	0	0	0.75K	NULL	NULL	A line of showers and thunderstorms moved east across northern portions of central Indiana during the afternoon of October the 6th. One of the stronger storms in the line helped to produce tree damage in a couple different locations along the path of the embedded storm.	The 911 Center reported a large tree limb down near County Road 550 East due to damaging thunderstorm wind gusts.

Day	Month	Year	Event Type	Injuries (Direct)	Injuries (Indirect)	Deaths (Direct)	Deaths (Indirect)	Property Damage	Crop Damage	Tornado Scale	Episode Narrative	Event Narrative
6	October	2018	Thunderstorm Wind	0	0	0	0	1.00K	NULL	NULL	A line of showers and thunderstorms moved east across northern portions of central Indiana during the afternoon of October the 6th. One of the stronger storms in the line helped to produce tree damage in a couple different locations along the path of the embedded storm.	A large, healthy tree was snapped near the base in this location due to damaging thunderstorm wind gusts.
12	January	2019	Heavy Snow	0	0	0	0	NULL	0.00K	NULL	Snow developed across portions of central Indiana ahead of an approaching area of low pressure. Plentiful moisture combined with strong isentropic lift produced a widespread area of heavy snow. This winter system led to the first January winter storm warning since 2014. Snow fell starting late Friday night and continued through Saturday night. During the afternoon on Saturday, temperatures slowly climbed above freezing across south central Indiana which led to lower amounts of snow. Snowfall totals ranged from 4 inches to as high as 9 inches in Owen County. The 6.9inches of snow at Indianapolis tied the snowfall record for the day.	Snowfall of 5 to 8 inches was observed across the county with the heaviest falling near Delphi.
7	April	2019	Hail	0	0	0	0	0.00K	0.00K	NULL	A band of scattered thunderstorms pushed east across northwest portions of central Indiana during the evening of April the 7th. As one storm pushed east south-east across the Lafayette area, it produced one severe damaging wind and two small hail events.	NULL
7	April	2019	Hail	0	0	0	0	NULL	0.00K	NULL	A band of scattered thunderstorms pushed east across northwest portions of central Indiana during the evening of April the 7th. As one storm pushed east south-east across the Lafayette area, it produced one severe damaging wind and two small hail events.	NULL
7	April	2019	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	A band of scattered thunderstorms pushed east across northwest portions of central Indiana during the evening of April the 7th. As one storm pushed east south-east across the Lafayette area, it produced one severe damaging wind and two small hail events.	A measured 61 mph thunderstorm wind gust was observed at the LAF ASOS.
27	May	2019	Hail	0	0	0	0	NULL	NULL	NULL	Thunderstorms developed near a warm front in an unstable environment, with plenty of low level shear/helicity, during the evening of Memorial Day, May 27th. This allowed the storms to rotate and rapidly became severe, producing tornadoes, large hail, and damaging winds. The storms and tornadoes damaged homes, brought down many trees and power lines, and produced heavy rain as well.	NULL
27	May	2019	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	Thunderstorms developed near a warm front in an unstable environment, with plenty of low level shear/helicity, during the evening of Memorial Day, May 27th. This allowed the storms to rotate and rapidly became severe, producing tornadoes, large hail, and damaging winds. The storms and tornadoes damaged homes, brought down many trees and power lines, and produced heavy rain as well.	A 72 mph thunderstorm wind gust was measured in this location.
27	May	2019	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	Thunderstorms developed near a warm front in an unstable environment, with plenty of low level shear/helicity, during the evening of Memorial Day, May 27th. This allowed the storms to rotate and rapidly became severe, producing tornadoes, large hail, and damaging winds. The storms and tornadoes damaged homes, brought down many trees and power lines, and produced heavy rain as well.	An estimated 60 mph thunderstorm wind gust was observed in this location.
27	May	2019	Thunderstorm Wind	0	0	0	0	1.00K	NULL	NULL	Thunderstorms developed near a warm front in an unstable environment, with plenty of low level shear/helicity, during the evening of Memorial Day, May 27th. This allowed the storms to rotate and rapidly became severe, producing tornadoes, large hail, and damaging winds. The storms and tornadoes damaged homes, brought down many trees and power lines, and produced heavy rain as well.	An estimated 60 mph thunderstorm wind gust was observed in this location. Large tree branches were downed and pea size hail was noted as well.
19	May	2019	Thunderstorm Wind	0	0	0	0	2.00K	0.00K	NULL	Instability and shear developed in between an area of rain and an approaching cold front. This allowed a line of strong to severe thunderstorms to developed ahead of the cold front during the afternoon of May 19th and move across central Indiana. The storms brought damaging winds, which downed trees and power lines. A pole barn was damaged in Shelby County.	A gazebo was destroyed due to damaging thunderstorm wind gusts.
23	May	2019	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	Warm and humid air moved into central Indiana, with an upper level high across the southeastern states, producing instability and shear across the area. A line of thunderstorms moved across central Indiana during the early morning hours of May 23rd.	A 62 mph thunderstorm wind gust was measured in this location.
23	May	2019	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	NULL	Warm and humid air moved into central Indiana, with an upper level high across the southeastern states, producing instability and shear across the area. A line of thunderstorms moved across central Indiana during the early morning hours of May 23rd.	A tree was down near this location due to damaging thunderstorm wind gusts. This report was relayed by broadcast media.
23	May	2019	Thunderstorm Wind	0	0	0	0	8.00K	0.00K	NULL	Warm and humid air moved into central Indiana, with an upper level high across the southeastern states, producing instability and shear across the area. A line of thunderstorms moved across central Indiana during the early morning hours of May 23rd.	A tree was down on a house due to damaging thunderstorm wind gusts. This report was relayed by broadcast media.
23	May	2019	Thunderstorm Wind	0	0	0	0	18.00K	0.00K	NULL	Warm and humid air moved into central Indiana, with an upper level high across the southeastern states, producing instability and shear across the area. A line of thunderstorms moved across central Indiana during the early morning hours of May 23rd.	A tree fell onto an apartment complex due to damaging thunderstorm wind gusts.
23	May	2019	Thunderstorm Wind	0	0	0	0	50.00K	0.00K	NULL	Warm and humid air moved into central Indiana, with an upper level high across the southeastern states, producing instability and shear across the area. A line of thunderstorms moved across central Indiana during the early morning hours of May 23rd.	A roof was torn and raised off of the Wabash National Corporation due to

Day	Month	Year	Event Type	Injuries (Direct)	Injuries (Indirect)	Deaths (Direct)	Deaths (Indirect)	Property Damage	Crop Damage	Tornado Scale	Episode Narrative	Event Narrative
												damaging thunderstorm wind gusts. Trailers were also overturned.
26	May	2019	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	An area of severe thunderstorms moved across northern portions of central Indiana during the early morning hours of May 26th. The storms produced straight-line wind damage.	A 58 mph thunderstorm wind gust was measured by the ASOS station at KLAF West Lafayette - Purdue University Airport.
26	May	2019	Thunderstorm Wind	0	0	0	0	7.00K	0.00K	NULL	An area of severe thunderstorms moved across northern portions of central Indiana during the early morning hours of May 26th. The storms produced straight-line wind damage.	Trees and utility lines were blown down on Howell Street due to damaging thunderstorm wind gusts.
26	May	2019	Thunderstorm Wind	0	0	0	0	8.00K	0.00K	NULL	An area of severe thunderstorms moved across northern portions of central Indiana during the early morning hours of May 26th. The storms produced straight-line wind damage.	Trees and utility lines were blown down with debris everywhere due to damaging thunderstorm wind gusts.
26	May	2019	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	NULL	An area of severe thunderstorms moved across northern portions of central Indiana during the early morning hours of May 26th. The storms produced straight-line wind damage.	A tree was blown down on Monitor Mill Drive due to damaging thunderstorm wind gusts.
26	May	2019	Thunderstorm Wind	0	0	0	0	5.00K	0.00K	NULL	An area of severe thunderstorms moved across northern portions of central Indiana during the early morning hours of May 26th. The storms produced straight-line wind damage.	Multiple tree limbs and utility lines were downed due to damaging thunderstorm wind gusts.
26	May	2019	Thunderstorm Wind	0	0	0	0	4.00K	0.00K	NULL	An area of severe thunderstorms moved across northern portions of central Indiana during the early morning hours of May 26th. The storms produced straight-line wind damage.	Siding and roof shingles were ripped off buildings at Crosswinds Apartments due to damaging thunderstorm wind gusts.
5	June	2019	Hail	0	0	0	0	NULL	NULL	NULL	Several places saw damaging winds topple trees into roads, cars, and a house. The storms started to develop over White and Benton counties with a general motion to the south east. By the time the storms reached Tippecanoe county they had strengthened enough to become severe. Several trees fell over onto yards and cars.	NULL
5	June	2019	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	Several places saw damaging winds topple trees into roads, cars, and a house. The storms started to develop over White and Benton counties with a general motion to the south east. By the time the storms reached Tippecanoe county they had strengthened enough to become severe. Several trees fell over onto yards and cars.	An estimated 60 mph thunderstorm wind gust was observed in this location.
5	June	2019	Thunderstorm Wind	0	0	0	0	NULL	NULL	NULL	Several places saw damaging winds topple trees into roads, cars, and a house. The storms started to develop over White and Benton counties with a general motion to the south east. By the time the storms reached Tippecanoe county they had strengthened enough to become severe. Several trees fell over onto yards and cars.	A 70 mph thunderstorm wind gust was measured at the intersection of South 500 East and East 1000 South.
5	June	2019	Thunderstorm Wind	0	0	0	0	5.00K	0.00K	NULL	Several places saw damaging winds topple trees into roads, cars, and a house. The storms started to develop over White and Benton counties with a general motion to the south east. By the time the storms reached Tippecanoe county they had strengthened enough to become severe. Several trees fell over onto yards and cars.	Several medium to large trees were uprooted on South 9th Street due to damaging thunderstorm wind gusts. This report was relayed via social media.
5	June	2019	Thunderstorm Wind	0	0	0	0	15.00K	0.00K	NULL	Several places saw damaging winds topple trees into roads, cars, and a house. The storms started to develop over White and Benton counties with a general motion to the south east. By the time the storms reached Tippecanoe county they had strengthened enough to become severe. Several trees fell over onto yards and cars.	Large tree limbs were downed onto cars near Brady lane due to damaging thunderstorm wind gusts. Other tree damage was noted across Lafayette.
5	June	2019	Flash Flood	0	0	0	0	100.00K	0.00K	NULL	Several places saw damaging winds topple trees into roads, cars, and a house. The storms started to develop over White and Benton counties with a general motion to the south east. By the time the storms reached Tippecanoe county they had strengthened enough to become severe. Several trees fell over onto yards and cars.	Water was as deep as 3 feet deep in portions of the Tippecanoe Mall with rapidly flowing water reported over the road in the subdivision behind the mall due to heavy thunderstorm rainfall. This report was relayed via social media.
5	June	2019	Flood	0	0	0	0	1.00K	0.00K	NULL	Several places saw damaging winds topple trees into roads, cars, and a house. The storms started to develop over White and Benton counties with a general motion to the south east. By the time the storms reached Tippecanoe county they had strengthened enough to become severe. Several trees fell over onto yards and cars.	There were reports of flooding along US Highway 52 due to heavy rainfall.
30	June	2019	Thunderstorm Wind	0	0	0	0	0.25K	NULL	NULL	A thunderstorm complex moved south into and through central Indiana during the evening of June the 30th, while other thunderstorms developed in very warm and humid air. Some of the storms produced damaging winds and large hail.	A measured 58 mph thunderstorm wind gust was observed at WLFI. Blowing dust from worked fields, west of town, filling the air. This produced a thick, dusty haze. Small, healthy limbs and leaves were flying

Day	Month	Year	Event Type	Injuries (Direct)	Injuries (Indirect)	Deaths (Direct)	Deaths (Indirect)	Property Damage	Crop Damage	Tornado Scale	Episode Narrative	Event Narrative
												through the air off a large pin oak tree, with hi
30	June	2019	Thunderstorm Wind	0	0	0	0	0.05K	NULL	NULL	A thunderstorm complex moved south into and through central Indiana during the evening of June the 30th, while other thunderstorms developed in very warm and humid air. Some of the storms produced damaging winds and large hail.	An estimated 60 mph thunderstorm wind gust was reported in this location. A one-inch diameter tree limb was downed here as well.
30	June	2019	Thunderstorm Wind	0	0	0	0	3.00K	0.00K	NULL	A thunderstorm complex moved south into and through central Indiana during the evening of June the 30th, while other thunderstorms developed in very warm and humid air. Some of the storms produced damaging winds and large hail.	Morehouse Road between County Roads 250 West and 500 North were closed due to downed power lines from damaging thunderstorm wind gusts.
20	August	2019	Thunderstorm Wind	0	0	0	0	1.00K	0.00K	NULL	A line of thunderstorms developed in Iowa early in the morning of August 20, 2019, and continued moving southeast through the afternoon hours. Thunderstorms developed thanks to an upper level wave. The upper wave interacted with the unstable atmosphere to produce the severe thunderstorms. The storms brought damaging winds to central Indiana during the early to mid-afternoon time frame. Trees and power lines were downed across the area. The Indianapolis International Airport reported a 73 mph wind gust with the storms. Nearly 40,000 people were without power due to the storms.	Small tree snapped due to thunderstorm wind gusts.
20	August	2019	Thunderstorm Wind	0	0	0	0	2.00K	0.00K	NULL	A line of thunderstorms developed in Iowa early in the morning of August 20, 2019, and continued moving southeast through the afternoon hours. Thunderstorms developed thanks to an upper level wave. The upper wave interacted with the unstable atmosphere to produce the severe thunderstorms. The storms brought damaging winds to central Indiana during the early to mid-afternoon time frame. Trees and power lines were downed across the area. The Indianapolis International Airport reported a 73 mph wind gust with the storms. Nearly 40,000 people were without power due to the storms.	Trained Spotter estimated 60 mph thunderstorm wind gust. Several tree limbs were downed due to thunderstorm wind gusts west of Teal Street and US Highway 52. Additional tree limbs were downed on Third Street.
26	October	2019	Strong Wind	0	0	0	0	1.00K	0.00K	NULL	A strong upper level low pressure system with influences from a remnant tropical system moved through central Indiana during the evening hours of October 26th. This system brought strong gradient winds and widespread rain to the area.	A tree was uprooted 3 miles west-southwest of Battle Ground due to strong gradient winds. The area had experienced heavy rain in the hours leading up to the strong winds which allowed for weaker winds to uproot the tree.
27	November	2019	High Wind	0	0	0	0	NULL	NULL	NULL	A strong upper level system brought strong gradient winds to much of Indiana with the strongest winds generally along and north of Interstate 70. These strong winds caused widespread power outages, damaged buildings, and caused significant tree damage. Over 200 crews were dispatched to return power to Marion County alone. At the peak of the event, at least 70,416 homes were without power.	A 58 mph non-thunderstorm wind gust was measured at the KLAF ASOS.
8	April	2020	Thunderstorm Wind	0	0	0	0	2.00K			A severe weather outbreak occurred during the evening hours of April 8th. A line of severe thunderstorms moved through central Indiana intitially causing large hail and damaging winds. As the storms progressed, the hail threat gradually decreased with wind speeds rapidly increasing. In addition to widespread 60 to 70 mph winds, the line of storms had several mesovortices that led to areas of enhanced winds up to 90 mph and produced an EF-1 tornado in Mooresville, IN.	Large tree limb snapped due to thunderstorm wind gusts over driveway. Relayed via broadcast media.
21	July	2020	Thunderstorm Wind	0	0	0	0	1.00K	0.00K		A fairly prolonged period of thunderstorms began during the early afternoon hours on July 21st and continued into the evening hours. The most significant damage occurred in eastern Tippecanoe county where large metal doors were blown off of a manufacturing plant. Thunderstorms continued into the evening causing sporadic wind damage before becoming sub-severe by midnight.	Multiple tree limbs of unknown size downed due to thunderstorm wind gusts.
21	July	2020	Thunderstorm Wind	0	0	0	0	25.00K	0.00K		A fairly prolonged period of thunderstorms began during the early afternoon hours on July 21st and continued into the evening hours. The most significant damage occurred in eastern Tippecanoe county where large metal doors were blown off of a manufacturing plant. Thunderstorms continued into the evening causing sporadic wind damage before becoming sub-severe by midnight.	Large metal doors were blown off of the Toyota Tsusho America Inc plant at the 5400 block of Haggerty Lane. A plant employee told local broadcast media that if not for the tornado warning and their resulting shelter in place employees would have been struck.
21	July	2020	Thunderstorm Wind	0	0	0	0	2.00K	0.00K		A fairly prolonged period of thunderstorms began during the early afternoon hours on July 21st and continued into the evening hours. The most significant damage occurred in eastern Tippecanoe county where large metal doors were blown off of a manufacturing plant. Thunderstorms continued into the evening causing sporadic wind damage before becoming sub-severe by midnight.	Multiple trees downed due to thunderstorm wind gusts with power outages noted.

Day	Month	Year	Event Type	Injuries (Direct)	Injuries (Indirect)	Deaths (Direct)	Deaths (Indirect)	Property Damage	Crop Damage	Tornado Scale	Episode Narrative	Event Narrative
7	July	2020	Thunderstorm Wind	0	0	0	0	2.00K	0.00K		During the afternoon hours of July 7th, a few storms became severe and led to isolated wind damage in Tippecanoe county near Dayton. Storms across the rest of the area produced winds that remained sub-severe with some small limbs noted to be downed in Hendricks county.	Several reports of large limbs and a few trees downed due to thunderstorm wind gusts on Newcastle Road one to two miles south of Interstate 65 and State Road 38. A report of corn also knocked down.
11	July	2020	Thunderstorm Wind	0	0	0	0	10.00K	0.00K		During the afternoon and evening hours of July 11th, a series of thunderstorms moved across central and north central Indiana producing widespread damaging winds and large hail. Significant power outages occurred across Indianapolis and surrounding cities. During the overnight hours, a more robust line of thunderstorms brought additional wind damage and large hail to areas that had already experienced thunderstorms earlier in the day.||Many areas had several rounds of thunderstorms. Times were not always exact and could have been from one of several thunderstorms.	Large tree uprooted onto a house due to thunderstorm wind gusts.
11	July	2020	Thunderstorm Wind	0	0	0	0	15.00K	0.00K		During the afternoon and evening hours of July 11th, a series of thunderstorms moved across central and north central Indiana producing widespread damaging winds and large hail. Significant power outages occurred across Indianapolis and surrounding cities. During the overnight hours, a more robust line of thunderstorms brought additional wind damage and large hail to areas that had already experienced thunderstorms earlier in the day.||Many areas had several rounds of thunderstorms. Times were not always exact and could have been from one of several thunderstorms.	Tree limbs, trees, and power lines downed due to thunderstorm wind gusts in in the nearby area.
11	July	2020	Thunderstorm Wind	0	0	0	0				During the afternoon and evening hours of July 11th, a series of thunderstorms moved across central and north central Indiana producing widespread damaging winds and large hail. Significant power outages occurred across Indianapolis and surrounding cities. During the overnight hours, a more robust line of thunderstorms brought additional wind damage and large hail to areas that had already experienced thunderstorms earlier in the day.||Many areas had several rounds of thunderstorms. Times were not always exact and could have been from one of several thunderstorms.	Trained spotter estimated a 60 mph thunderstorm wind gust at this location. Power was out at his location as well.
10	August	2020	Thunderstorm Wind	0	0	0	0	50.00K	0.00K		On August 10th, an intense derecho brought severe to extreme winds to much of the Midwest with winds estimated as high as 130 to 140 mph in Iowa. As the derecho neared Indiana, the storms were not quite as intense, but did produce measured winds up to 70 mph and caused significant tree damage and power outages to the local area. Over 100,000 people were without power at one point with power outages lasting several days across portions of the state.	Numerous trees and limbs downed due to thunderstorm wind gusts around Battle Ground Indiana. Video and lots of pics of tree damage were received. Also, widespread power outages from Battle Ground to Burrows reported with much of Delphi without power.
10	August	2020	Thunderstorm Wind	0	0	0	0	1.00K	0.00K		On August 10th, an intense derecho brought severe to extreme winds to much of the Midwest with winds estimated as high as 130 to 140 mph in Iowa. As the derecho neared Indiana, the storms were not quite as intense, but did produce measured winds up to 70 mph and caused significant tree damage and power outages to the local area. Over 100,000 people were without power at one point with power outages lasting several days across portions of the state.	A 16 inch diameter tree was uprooted due to thunderstorm wind gusts at this location.
10	August	2020	Thunderstorm Wind	0	0	0	0				On August 10th, an intense derecho brought severe to extreme winds to much of the Midwest with winds estimated as high as 130 to 140 mph in Iowa. As the derecho neared Indiana, the storms were not quite as intense, but did produce measured winds up to 70 mph and caused significant tree damage and power outages to the local area. Over 100,000 people were without power at one point with power outages lasting several days across portions of the state.	A 63 mph thunderstorm wind gust was measured at this location.
29	August	2020	Thunderstorm Wind	0	0	0	0	1.00K	0.00K		During the overnight hours from August 28th to the 29th, a series of thunderstorms moved across north central Indiana. One storm briefly produced damaging winds across southwest Tippecanoe county before gradually weakening as it moved to the southeast.	Tree limbs of unknown size downed across portions of southwest Tippecanoe county.
8	September	2020	Hail	0	0	0	0				An isolated strong storm produced large hail across Tippecanoe county during the evening hours of September 8th. A frontal boundary was located north of the forecast area and a thunderstorm formed as a result of afternoon heating. This storm rapidly grew in height before briefly producing hail up to golf balls. The night before, a complex of storms moved over north central Indiana which brought heavy rain to portions of Tipton and Howard counties. This rain brought flooding to the town of Windfall.	Mostly nickel sized but a few were up to the size of golf balls.
22	June	2020	Thunderstorm Wind	0	0	0	0	2.00K	0.00K		Scattered thunderstorms during the afternoon and early evening hours evolved into a more widespread area of heavy rain and thunderstorms by the early overnight hours. A few areas of isolated wind damage occurred in Vigo and Tippecanoe counties with most storms staying sub-severe.	Window was blown in at IU Arnett Hospital. Damage is suspected to be due to thunderstorm wind gusts, but could not get a definitive answer.